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**RECONNECTING INDIGENOUS KNOWLEDGE TO THE SUNLIGHT BASIN:
INTEGRATING TRADITIONAL ECOLOGICAL KNOWLEDGE AND
ARCHAEOLOGY**

By

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Anthropology (B.A.), University of California, Berkeley, 2012

Thesis Paper

Presented in partial fulfillment of the requirements for the degree of:

Master of Arts
in Anthropology

The University of Montana
Missoula, MT

Official Graduation Date: December 2019

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ACKNOWLEDGEMENTS

The collaborative nature that guides this research, is not only evident in text, but is evident in the connections I have made during the process. Individuals from various disciplines, with distinct worldviews and knowledge bases have been instrumental in my success. To Donna and Bill Dolinar, my parents and most staunch supporters who have never wavered in guiding me towards my goals. To those young classmates, Nicolas Ames and Mackenzie Constantinou, and professors, Dr. Benjamin Porter who inspired me during long field seasons in Jordan. To those along the way that have shaped me personally and professionally. To Dr. Nicole Herzog for her expertise, advice, and friendship. To Dr. Kelly Dixon for encouraging me during the formulation of my research ideas. To Dr. Rosalyn LaPier for inspiring me towards a more collaborative approach. To my committee chair Dr. Anna Prentiss, thank you for steering me in the right direction, but also trusting in my ideas. To those peers who I have shared countless coffees, beers, and discussions with, Ethan Ryan, Emma Vance, Ashley Hampton, Cheyenne Laue, Haley O'Brien, Jeannie Larmon, and especially Kaitlin Pipitone, our hikes and discussions have fueled and inspired this work. Thank you to Joshua Mann for facilitating interviews with the Eastern Shoshone community and supporting my research endeavor, along with the Eastern Shoshone Tribal council for approving my research in its preliminary stages. Finally, I want to thank Curtis Barney for sharing your time and knowledge with me during our interviews. Your knowledge, enthusiasm, and hope has added so much to this research and I am truly thankful you were a part of it.

ABSTRACT

Dolarin, Elizabeth A., M.A., Fall 2019

Anthropology

Reconnecting Indigenous Knowledge to the Sunlight Basin: Integrating Traditional Ecological Knowledge and Archaeology

Chairperson: Dr. Anna Marie Prentiss

Traditional ecological knowledge (TEK) specific to plants has been developed over long-term connections to the environment, diligent observations, and practical experience by Indigenous communities. The traditional ecological knowledge of Indigenous peoples is a vital source for the contextualization and further understanding of past human environmental relationships in the Sunlight Basin of northwestern Wyoming. The Eastern Shoshone people, among many other groups, traditionally occupied the Sunlight Basin of northwestern Wyoming, a region of the Greater Yellowstone Ecosystem. There is a growing necessity for collaboration with Indigenous populations within archaeological and anthropological research. The aim of this project is to develop a synthesized body of work that incorporates traditional plant harvesting practices and the general plant knowledge of the Eastern Shoshone community, supported by historic ethnographic research, contemporary ethnographic interviews, plant surveys, and post excavation paleoethnobotanical analysis. These lines of investigation and support the traditional ecological knowledge of local and Indigenous communities. The collaboration of these three modes of investigation will reveal that TEK can contextualize cultural landscapes by providing highly specialized details about local ecosystems.

CHAPTER 1: INTRODUCTION

This research is part of the ongoing Sunlight Basin Archaeological Project, which began conducting preliminary archaeological investigations at archaeological site 48PA551 in June 2017. Following preliminary geophysical survey, mapping, and relocation of previous excavations the 2018 field season began excavations across the site to address questions about the complexity of human occupation and environmental relationships during the Middle Archaic period (ca. 3000-5000 years ago) in northwestern Wyoming.

This study stems from the understanding that there is a great need in the field of anthropology, specifically archaeology, for the inclusion of a multitude of perspectives to understand the complexities of the past. For this thesis inclusivity refers to those perspectives that have often been placed in opposition to scientific research, which includes those worldviews of Indigenous communities. Indigenous knowledge bases and perspectives maintain a distinct worldview from Western science and allow for a wider and richer view of the archaeological record. A multitude of perspectives offers a more holistic approach to archaeological study. It is the goal of this research to prioritize the traditional ecological knowledge of Indigenous communities, specifically the Eastern Shoshone people who have lived on and constructed cultural landscapes within the Sunlight Basin for generations. The collaboration of distinct knowledge bases and inclusion of traditional ecological knowledge of the Eastern Shoshone with archaeological investigations contributes to the further contextualization of archaeological material at site 48PA551.

The Eastern Shoshone people are one of the many occupants who traditionally inhabited and utilized this region of northwest Wyoming. Working within the frameworks of Indigenous Archaeology and Landscape Archaeology this project attempts to better contextualize both past

and present archaeological material through the application of traditional ecological knowledge (TEK). Culturally significant food plants can be identified through traditional knowledge, historic documentation, and archaeological material. Implementing multiple lines of evidence allows this research to contribute to remedying of the exclusion of traditional knowledge bases. This research collaboratively integrates TEK of the Eastern Shoshone Tribe with archaeological research as a source of knowledge that is appreciated because it offers a distinct worldview and understanding of human relationships with the environment.

ENVIRONMENTAL AND ARCHAEOLOGICAL CONTEXT

The Sunlight Basin of northwestern Wyoming runs along the eastern foothills of the Absaroka Mountain Range and provides a distinct environment suitable for high elevation human habitation. Archaeological site 48PA551 is located in the southeastern region of the Sunlight Basin. The site sits at an elevation of 6,100 feet on stream terraces formed by a perennial stream that borders it on the west. Slopes that rise steeply on either side of the flat stream terrace provides the shelter necessary for human occupation (Frison and Walker 1984:15). This site was first visited by archaeologist in 1967, as well as subsequently in 1969, 1971, and 1972. The Wyoming Archaeological Society (WAS) held archaeological excavations under the supervision of George Frison (Prentiss 2019:3). Extensive excavation during the early 1970s yielded a variety of hearth feature types, a small pit house, and artifacts including 566 projectile points and point fragments, 259 other chipped stone tools, 55 ground stone tools, and an assortment of bone tools (Frison and Walker 1984:23). Three separate radiocarbon dates were obtained spanning 3800+/-110 to 4430+/-250. The projectile point styles and types at 48PA551 are indicative of this time period (Frison and Walker 1984:111). Although, there is some

evidence for occupation of 48PA551 during the Early Archaic, previous archaeological investigations associate the primary use and heavy human occupation to the Middle Archaic period (ca. 3000-5000 years ago).

The Middle Archaic period is best typified by the McKean Complex, which immediately followed the Early Archaic of the plains, based on evidence from multiple stratified archaeological sites in the Bighorn Basin and contiguous mountain slopes (Frison and Walker 1984:111). The McKean Complex is distinct for usage of a multitude of microenvironments including arid desert basins, foothills, and high elevation mountains for broad spectrum foraging. Socio-economic strategies on the northwest Plains were diverse, subsistence patterns appear to be focused on a wide variety of activities such as intensive plant processing using groundstone tools, as well as intensive bison, sheep, and deer predation (Kornfeld et al. 2010). McKean Complex sites range from small camps focused on specialized activities to large, densely occupied camps or villages, some with pithouse features (Prentiss 2019:4). Previous excavations at site 48PA551 yielded the uncovering of 55 groundstone tools, along with deep, wide, prepared fire pits containing evidence of fire cracked rock, possibly oriented toward ‘vegetable food gathering’ and cooking (Frison and Walker 1984:111). Frison and Walker (1984) argue that 48PA551 was a cold weather occupation, based on evidence of deer, mountain sheep, and other animal remains recovered at the site that are indicative of favorable over wintering conditions.

The research of the Sunlight Basin Archaeological Project is focused on emerging socio-economic strategies of the Middle Archaic, McKean Complex and gaining insights into such strategies that begin to become more developed and characteristic in the Late Archaic Period. Prentiss et al. (2017) developed three alternative hypotheses for testing, regarding the socio-economic strategies utilized during human occupation of 48PA551 throughout the Middle

Archaic. Hypothesis A suggests that expanding game populations in the foothill and montane regions, along with increased moisture may have created attractive areas that could be used as high productivity centers, like the Sunlight Basin, and with continued use the strategy of winter-sedentism was developed through logistical organization, hunting and gathering, intensive food processing, and food storage in pits. Hypothesis B asserts instead that site material at 48PA551 accumulated from occupation by people from arid desert regions just expanding into new territory, with no distinct alterations to mobility and subsistence strategies. Lastly, Hypothesis C suggests that 48PA551 was used by groups, practicing annual to semi-annual sedentism in highly productive microenvironments that could be exploited seasonally (Prentiss et al. 2017:9). These three hypotheses developed for the Sunlight Basin Archaeological Project focus on the further understanding and contextualization of the Middle Archaic, McKean Complex occupations of 48PA551. This research seeks to answer similar questions about the McKean Complex of 48PA551 through an explicit focus on plant harvesting and processing strategies. There is a distinct absence of botanical analysis from excavated materials during the early 1970s. The argument that the occupants of McKean Complex sites developed subsistence strategies that relied heavily on the development of a broad-spectrum diet with intense harvesting and processing of food plants, makes botanical analyses and traditional plant knowledge a vital component to the archaeological investigation into the McKean complex occupation at 48PA551.

This thesis consists of a total of eight chapters, along with an appendix that contains additional figures pertinent to this research. Chapter 2 will be an overview of paleoethnobotanical methodologies in archaeology. A summary of the emergence of paleoethnobotanical analysis, along with the formation processes of macrobotanical and microbotanical assemblages will be discussed.

Chapter 3 will involve the discussion of traditional ecological knowledge (TEK) and the value of the implementation of this knowledge base into archaeological research. Following this introduction to TEK, the traditional knowledge specific to the Eastern Shoshone community will be discussed to illuminate the collaborative goals of this study.

Chapter 4 will involve a discussion of the collaborative frameworks of Indigenous Archaeology and Landscape Archaeology. These theoretical approaches facilitate a collaborative framework that allows for the inclusion of various perspectives and the formulation of research questions and hypotheses.

In Chapter 5 will introduce the hypotheses and text expectation of the Sunlight Basin Archaeological Project and how the work of this thesis relates to complements this research.

The multi-disciplinary methodology will be discussed in Chapter 6 and will highlight the collaborative nature of this research. This will include a discussion of the methodologies employed during ethnographic interviews, botanical surveys, and paleoethnobotanical analysis.

Chapter 7 will include the results of the analyses, leading to a discussion of how they relate to earlier research questions and hypothesis. The beginning of this section will look at the results of contemporary ethnographic interviews and plant surveys. Following this, the bulk of this section discusses the results of the paleoethnobotanical analysis by excavation unit.

Chapter 8 will conclude the study and summarize the overall findings and discuss the implications of this study, along with ideas for future research.

CHAPTER 2: EMERGENCE OF PALEOETHNOBOTANICAL ANALYSIS

To further understand the Middle Archaic, McKean Complex occupations at 48PA551, multiple lines evidence are employed. This research will focus on the importance of accounting for the use of plants in the past both with the inclusion of traditional ecological knowledge of Indigenous communities and through laboratory analysis of botanical components from excavated materials. The primary historic ethnographic documents used for this project (Shimkin 1947) spends ample time highlighting the traditional plant names and uses of the Eastern Shoshone, followed by a dismissal of these plants as valuable food sources; “while plants balanced diet, they were quantitatively of no great value” (Shimkin 1947:269). Botanical analyses and past human relationships with plants have long been considered only minor contributors to archaeological studies. This underrepresentation of ethnobotanical analysis in archaeology stems from the discipline’s predilection for hunting as the primary and most important subsistence strategy of hunter-gatherer groups. In 1966 the *Man the Hunter* conference and the published volume of the same name explicitly display the biases present in archaeological research, specific to hunter-gatherer societies. Lee and DeVore (1968) portray male hunting activities as the most important subsistence strategy within hunter-gatherer societies. The authors discuss that ‘man’ is meant to refer to all humans while ‘hunter’ refers to both hunting and gathering, but there is no real consideration of the importance of gathering (Sterling 2014). *Man the Hunter* sparked critical reactions during this time, when more women were being represented in anthropology and with the political relevancy of feminist theory.

Feminist theory critiques the erasure of women’s roles in archaeology. The selection of specific research questions and only working within certain types of sites and cultural complexes, along with how women and gender are represented, when they are taken into account all play a role in this exclusion (Wylie 1997). Contemporary concepts of gender can often

become attached to the past and perpetuate biases that label gathering and foraging activities simply as ‘women’s work,’ implying that plant gathering is far less significant form of subsistence than hunting. Watson and Kennedy (1990) focus on the emergence of horticulture in the Eastern Woodlands. Their research discusses the blatant removal of women’s roles in the transition to horticulture, despite the integral role women played in the gathering of plants prior to the transition to horticulture and the cultivation and management after the transition. This transition is instead explained by shaman intervention or the self-domestication of plants, effectively eliminating the agency of women as active participants in the domestication of plants. This notion also counters paleoethnobotanical evidence suggesting human intervention in the form of cultivation and harvesting practices were a key part of plant domestication. As shown by evidence of early domesticates that have been found in sub-optimal environments, in which human intervention was necessary for the survival of the plants (Wylie 1997:96). Ethnographic work with the Eastern Shoshone Tribe (Shimkin 1947) identifies and documents a multitude of plants that are culturally significant to the tribe. But there is still a disproportionate focus on hunting activities that has perpetuated the avoidance of research focused on plant gathering, producing research that does not accurately represent the subsistence traditions of the past.

Along with these biases, it is probable that the underrepresentation of botanical analyses in archaeology stems from the lack of viable evidence present. Evidence of plant material in the archaeological record is much more difficult to find intact, it requires more intense and complex lab processing, and it is more prone to degradation in the archaeological record, than say lithic material. A combination of factors has led to the underrepresentation of botanical analyses in archaeology. Gathered plant foods are a vital, primary source of nutrition and a staple to the diets

of peoples in the past and present. Omitting intense analysis of botanical remains is a misrepresentation of the subsistence strategies and human interactions with their environments.

A growing interest in the dynamics between Native Americans and plant use began to develop around the turn of the 20th Century. The research of Powers (1874) focused on plant use by the California Native American Tribes, defined as “aboriginal botany” (Richard I. Ford 2011:16). J.W. Harshberger (1896), a botanist from the University of Pennsylvania was the first to use the term ethno-botany. He used the term to characterize his observations of the Wetherill collection of plant products from Mancos Canyon, Colorado and his own examination of ancient plant remains found in cliff dwellings in the southwest. David Barrows (1900) produced the first PhD explicitly dedicated to the field of ethno-botany. This early work of Barrows focused on the ethno-botany of the Cahuilla Tribe of Southern California and is an example of an elaborate and detailed investigation into human and plant relationships that discusses plant use, environment, and recorded beliefs about plant and human ecological interactions. In the 1930s the work of Melvin Gilmore and Volney H. Jones at the University of Michigan Museum of Anthropology, Ethnobotanical Laboratory begins to formalize the field and characterize modern ethnobotany. This work moves beyond mere taxonomic identification and use of plants and focuses on the ecological interactions of human populations and the plants to answer more complex questions concerning plant domestication and dietary change over time (Pearsall 1989). The formation of modern ethnobotany requires the development of collection methods, analytical procedures, and interpretive models that can provide accurate information about human environmental interactions from plant remains (Hastorf 1988). The discipline of ethnobotany continues to study the relationships between people and plants as an approach to better understand humanity and its place in the natural environment.

Paleoethnobotany is included in the field of ethnobotany and is specifically interested in understanding human-plant relationships in the past through the study of plant remains within archaeological contexts. This research is grounded in paleoethnobotanical methodologies. The method of flotation was introduced by Struever (1968) as a method to recover carbonized plant remains from archaeological sediment. Flotation is a technique that can be applied to a variety of archaeological sites and was quickly put to use at a number of archaeological sites during this time. Manual flotation is the most straight-forward application of the flotation technique; sediment samples from archaeological contexts are submerged in water and agitated in a clean vessel or bucket. Another vessel is covered with a fine mesh or screen material and the submerged sediment sample is slowly poured and strained through the mesh (White and Shelton 2014:101-102). Carbonized plant remains float to the top and the bucket and when strained are caught in the mesh. This portion of the sample is referred to as the light fraction (LF). Once dried these light fraction samples can be sorted to identify any paleoethnobotanical macrobotanical remains present in the sample. Due its simplicity salvage archaeology projects as well as large scale Cultural Resource Management (CRM) projects during the 1970s and 1980s adopted flotation for macrobotanical analysis, which produced massive botanical data sets. The sheer amount of a botanical data that was recovered using flotation called for a comprehensive methodological framework for paleoethnobotanical material to be analyzed (Marston et al. 2014:4)

Pearsall (1989) and Hastorf and Popper (1988) discuss the implication of paleoethnobotanical research through a theoretical framework, for the interpretation of past formation processes, agricultural activities, environmental reconstruction, and cultural shifts. Paleoethnobotany plays a major role because of the production of a “robust data sets that reflect

interactions between human and botanical communities over long spans of time and across economic, social, geographic, and climatic transitions” (Marston, et al. 2014:14). Throughout time humans have relied on plants for a variety of needs, including, but not limited to food, fuel, shelter, clothing, and tools. Pursuing paleoethnobotanical lines of research can illuminate the ways in which the natural environment and cultural development are interrelated. Plants are not simply used by people, “any interaction between people and plants occurs within intricate cultural and environmental contexts” (Minnis 2000:3).

Prior investigations at 48PA551 did not include any paleoethnobotanical analyses. There is no documentation of a systematic strategy for sampling archaeological sediments for either macrobotanical or microbotanical remains. Paleoethnobotanical techniques of flotation, pollen analysis, phytolith analysis, and starch granule analysis were not employed during the original project. Hypotheses concerning the occupation of 48PA551 during the McKean Complex of the Middle Archaic Period are characterized by an increased emphasis on plant foods with a more prevalent occurrence of groundstone tools: manos, metates, and abraders (Kornfeld et al. 2010:114). Excavations at the site during the early 1970s yielded a total of 55 groundstone tools including grinding, abrading, perforated, or incised stone artifacts. The majority (43) of those artifacts are categorized as grinding stones, comprised of both handheld manos and metate slabs. Of the 43 groundstone artifacts 19 are characterized as metates or metate fragments, with 9 complete metate slabs recovered. These types of groundstone tools are indicative of foraging based subsistence strategies focused on the gathering and processing of edible plants (Frison and Walker 1984:39). Unfortunately, no further controlled investigations were employed for macrobotanical or microbotanical analyses to determine the types of plant foods being processed with groundstone tools at 48PA551. The explicit goal of this research is to further investigate the

subsistence strategies and the dynamic relationships between humans inhabiting 48PA551 and the environment of the Sunlight Basin during the Middle Archaic Period.

FORMATION PROCESSES OF PALEOETHNOBOTANICAL RECORD

These interactions between people of the past and plants are a necessary component to more fully contextualize how people lived within the environments of the past. To further explore the various subsistence strategies, particularly those related to the gathering and processing of plant foods, the inclusion of paleoethnobotanical techniques are necessary. What follows is a description of the macrobotanical and microbotanical material remains, and the formation processes of the paleoethnobotanical record. The macrobotanical record consists of all plant remains that are large enough to be seen by the naked eye and can be identified using a low power microscope. These types of remains vary significantly in size, including plant remains from the size of a tobacco seed (<1mm diameters), to a cedar bark basket, to a preserved dugout canoe (Marston, et al. 2014). Macrobotanical remains encompass any and every part of the plant including roots, stems, fibers, wood, sap, leaves, flowers, nuts, fruits, seeds, etc. The preservation integrity of exposed and subsurface macrobotanical remains is highly dependent on biological, chemical, and geochemical weathering processes. Such processes destroy the majority of plant remains, but the macrobotanical plant parts that do remain intact within archaeological contexts are regularly preserved due to human intervention and plant processing techniques. “Preservation in archaeological contexts depends less on the durability of the plant itself and more on environmental conditions and/or processes, such as carbonization, that improve the chances of preservation” (Gallagher 2014:21).

The types of environments that are best suited for the preservation of macrobotanical remains, separate from human processing strategies, are in those environments that lack moisture or oxygen, have consistently high or freezing temperatures, and/or have acidic or nutrient poor substrates. Macrobotanical material will preserve well when they have undergone transformations either pre or post deposition through the processes of carbonization or mineralization. Dry preservation or desiccation is associated with desert environments and occurs with the continued absence of moisture. This lack of moisture over long periods of time prevents the microorganisms that drive decomposition from prospering. In contrast, in very wet environments the preservation of plant material can also be prevented from decomposing within anaerobic environment, which frequently occurs in waterlogged conditions. Environments that are conducive to dry and wet preservation offer the most diverse and best preserved macrobotanical specimens, but the majority of archaeological sites do not exist in such conditions. Without the presence of other transformative processes organic plant material will quickly decompose and be removed from the archaeological record. Mineralization and carbonization are both transformative processes that convert organic compounds to inorganic structures. Mineralization is a rare occurrence where the organic material of the plant structure is replaced by minerals present in the surrounding substrate. This transformative process usually occurs in phosphate rich contexts such as latrines or coprolites or in direct contact with corroding metals and can preserve the anatomical structure of the plant. On the other hand, carbonization most commonly occurs and accounts for the bulk of macrobotanical remains recovered from archaeological contexts. Carbonization also referred to as charring, is the process of converting organic material to an inorganic structure that consists primarily of carbon through the exposure to heat, usually in a low oxygen environment (Marston et al. 2014). Once plant remains are

carbonized many plant parts are preserved. Carbonized seeds, seed like parts, nutshell, and wood charcoal can be identified through macrobotanical analysis.

To fully comprehend the macrobotanical record various preservation processes must be understood, as well as the various formation processes of the macrobotanical assemblage. Plant remains end up in archaeological contexts via four primary processes; direct anthropogenic, indirect anthropogenic, non-anthropogenic, and post depositional processes. Direct anthropogenic refers to plant species that were intentionally brought to sites by humans during gathering, cultivation, and processing of plant foods. In this scenario the specific plant was purposefully selected for important properties, frequently brought into cultural/habitation space where it was preserved as an archaeological deposit. From the preserved paleoethnobotanical remains archaeologists can gain insight into cultural and environmental contexts of the past (Marston et al. 2014). The other three formation processes of macrobotanical assemblages make it more difficult to determine which plant remains are intentionally brought into sites. Indirect anthropogenic refers to those plant remains that are accidentally brought into archaeological contexts, most likely collected with other useful plants. Non-anthropogenic refers to the variety of plants that enter archaeological sites through natural causes. For example, seeds can be widely dispersed and become carbonized by wildfires. Post depositional processes occur when the botanical assemblages are altered after the site has been abandoned by humans. Examples include sediment shifting, trampling, flooding, bioturbation, erosion, etc.

Microbotanical remains are those plant remains that are microscopic and cannot be seen or identified with the naked eye. Microbotanical analysis identify and analyze starch granules, pollen, and phytoliths within archaeological contexts. This project utilizes the microbotanical technique of starch granule analysis. Starch granules are able to preserve in the archaeological

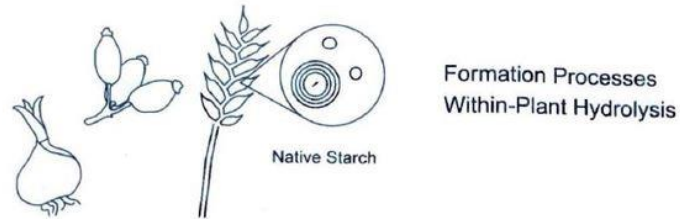
record due to their semi-crystalline structure, insolubility in water, and sheer numbers produced by plants. “Their taxon-specific morphology and the manner in which they preserve signs of intentional processing are powerful markers of human dietary behavior” (Henry 2014:35). A starch is a complex carbohydrate that is produced by plants as a means of energy storage and transport. Higher plants, those of relatively complex or advanced characteristics, especially vascular plants produce transitory and reserve starch granules within their chloroplasts. Transitory starch granules accumulate briefly before being degraded, while reserve starch granules are used for energy storage over long periods of time. These form in the storage tissues of plants; roots, seeds, tubers, and occasionally within unripe fruit. Reserve starch granules, unlike transitory starch granules, take on species specific shapes that can be identified through paleoethnobotanical analysis. The crystalline shells (lamellae), pores, vacuoles, and cracks visible on starch granules under light microscopy and scanning electron-microscopy (SEM) are species specific (Marston et al. 2014).

The effects of human processing can be observed, along with species specific characteristics (Figure 1). For starches to be successfully digested for optimal caloric intake by humans the starch granule structure is altered through processes including grinding and cooking. Post processing starch granules retain some physical and chemical features to be identified by plant taxon, as well as provide information about the way they were processed based on damage to the original structure. Damage from grinding plant foods can be seen under light microscopy as radial cracks or increased susceptibility to swell significantly in room temperature water. The type of cooking and intensity influences the type and degree to which a starch granule will be damaged. Even after being cooked many starch granules retain most, if not all diagnostic morphological features (Marston et al. 2014).

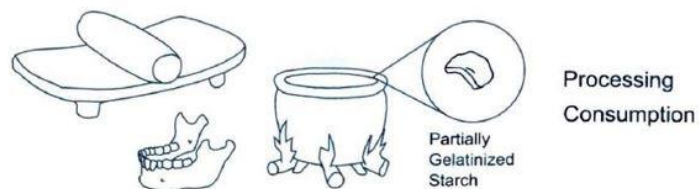
Starch Granule Life History

Factors affecting starch granule appearance and numbers

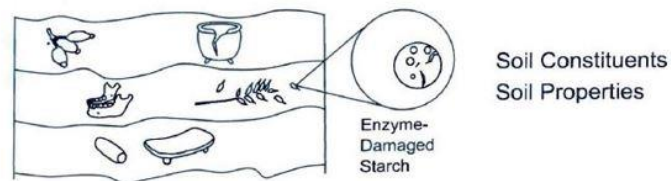
1. Starch Production within Plant



2. First Human Interaction



3. Discard and Burial



4. Excavation and Laboratory Processing

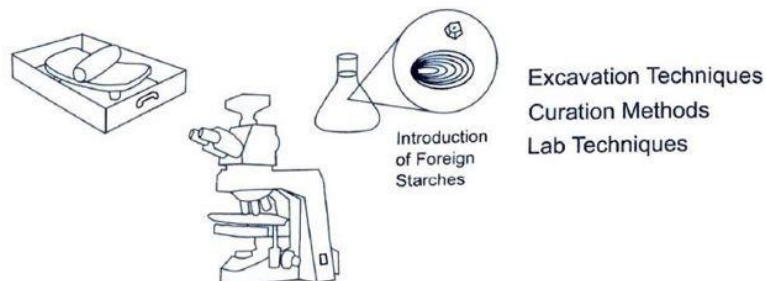


Figure 1: Starch granule 'life history' diagram (Henry 2014:43)

CHAPTER 3: TRADITIONAL ECOLOGICAL KNOWLEDGE AND THE EASTERN SHOSHONE PEOPLE

Losing a plant can threaten a culture in much the same way as losing a language. Without sweetgrass, the grandmothers don't bring the granddaughters to the meadows in July. Then what becomes of their stories? Without sweetgrass, what happens to the baskets? To the ceremony that uses these baskets? The history of the plants is inextricably tied up with the history of the people... [Kimmerer 2013:261].

Indigenous communities often have deep connections to landscape, natural resources, and the local environments these communities have interacted with and resided in for long spans of time. Traditional ecological knowledge is highly accurate, flexible, and adaptable. The body of knowledge known as traditional ecological knowledge (TEK) is defined by Fikret Berkes (2018) as:

A cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and their environment [2018:8].

This body of knowledge is a product of direct human contact with the environment and benefits from accumulated experiences with local ecosystems from a long-term, multi-generational perspective. The connectivity between Indigenous peoples of the past and their natural environment, along with the deep environmental knowledge systems form cultural landscapes. Cultural landscapes need to be contextualized within the cultures and traditions in which they were created. "The value of a landscape could not be assessed by anyone outside the particular Indigenous community that values it;" a lack of tangible physical remains on the landscape may not equate to a lack of value for Indigenous descendant communities (Teeman 2008, 630).

The cultural contexts of traditional knowledge include the intangible spiritual connections and life experiences that occur on and across landscapes. Indigenous knowledge is taught and acquired in an intrinsically different worldview from other knowledge bases rooted in Western science. It is sometimes difficult for traditional knowledge holders to translate their knowledge

into analytic language because the nature of TEK is experiential and culturally constructed from procedural knowledge (Anderson et al. 2011). In a broad sense, science can be defined as knowledge of the natural world that is not only accurate, but is predictive, defined by certain key postulates, and able to incorporate new knowledge (Anderson et al. 2011:4). TEK certainly fits within the confines of this definition. Kimmerer (2013) describes TEK as a scientific theory with an example of sweetgrass harvesting. Only 50% of the sweetgrass is taken during harvest, a management guideline created following thousands of years of observed plant response to harvest, subjected to review by generations of practitioners, and validated, leading to well tested theories grounded in traditional ecological knowledge (Kimmerer 2013:159). Many Indigenous communities are active managers and cultivators of plants through the use of fire and sustainable harvesting practices by harvesting only strips of bark, transplanting, and selecting root vegetables by size (Deur and Turner 2005). Such practices have led to both the resilience of these populations and their traditional knowledge.

TEK of Indigenous communities, especially traditional plant use and processing knowledge, is imperative to understanding the development of specific subsistence strategies and traditional mobility patterns. It is a necessity for disciplines such as anthropology and archaeology to promote TEK in conjunction with Western science as a legitimate way of understanding past human relationships with the environment. TEK is implemented into this research as a collaborative tool between Indigenous peoples and archaeologists that can provide a way to account for and begin to remedy actions of the past, while hopefully restoring cultural continuity to those landscapes that were traditionally inhabited.

A growing number of scholars (Berkes 2018; Menzies 2006; Minnis 2000; Turner 2014) implement the TEK of Indigenous communities into research focused on past and present human

relationships with the environment. Basso (1996) promotes the value of Indigenous knowledge in anthropological research by highlighting Western Apache life histories and connections to their local environments. This work contextualizes the TEK of the Western Apache in a way that is culturally specific and aims for the restoration of identity and continuity to the landscape. Turner and Ignace (2000) have worked with the Interior Salish people of south-central British Columbia to study traditional plant use, for the identification the ideal habitats for specific dietary foods. For generations avalanche lily and balsamroot have been vital staples to the diet of the Salish community. Practical experiences in cultivation and knowledge of the ideal environments/habitats has produced high production and growth rates of these plants. This knowledge is combined with cultural philosophies concerned with respect for nature have led to sustainable harvesting techniques to ensure these plants are productive and continue to be abundant in the region. Berkes (2018) examines traditional Cree caribou hunting practices. Indigenous Cree hunters of northern Canada understand the nuances and intricacies of cyclical caribou movement by long term observations and monitoring techniques. Such monitoring techniques are employed to observe movement patterns, to determine the location of winter hunting camps and reduce uncertainty in future hunts (Berkes 2018, 137). These examples represent the regional environmental knowledge embedded in the TEK of specific Indigenous communities.

This research focuses on the traditional knowledge of the Eastern Shoshone Tribe, who traditionally occupied this region of northwestern Wyoming. The Crow, Apsáalooke people also traditionally inhabited and utilized this region amongst the Absaroka Mountain Range. The concentration on the traditional plant knowledge of the Eastern Shoshone is not meant to discount the knowledge of other Indigenous groups that traditionally used this landscape, instead

it is a tool to spark a discussion for the inclusion of traditional knowledge bases into archaeological research. This is a starting point on which to move forward.

The Eastern Shoshone people retain traditional ecological knowledge, specific to culturally significant plant foods that are found in the Sunlight Basin of northwestern Wyoming. The Sunlight Basin, and more broadly the Greater Yellowstone Ecosystem (GYE), was a traditional landscape of the Eastern Shoshone and their ancestors for many generations (Teran et al. 2008) (Figure 2). The Wind River Reservation was established in 1868 under the Treaty of Fort Bridger, followed by the formation of Yellowstone National Park in 1872 and the Shoshone National Forest in 1891, as part of the Yellowstone Timber Reserve. These acts greatly altered the once contiguous homelands of the Eastern Shoshone, shifting seasonal mobility patterns and affecting the continuance of location specific cultural activities outside of reservation lands. Although, most of the Eastern Shoshone population resides on the Wind River Reservation, community members retain traditional knowledge and expertise about landscapes beyond the confines of reserved lands. These deep, long term environmental connections, observations, and practical experiences embody TEK. The connections of the Eastern Shoshone to the landscape make traditional knowledge bases indispensable to continued contextualization at site 48PA551. More importantly TEK can begin to repair connections and cultural continuity to these traditional landscapes that are no longer inhabited by these communities

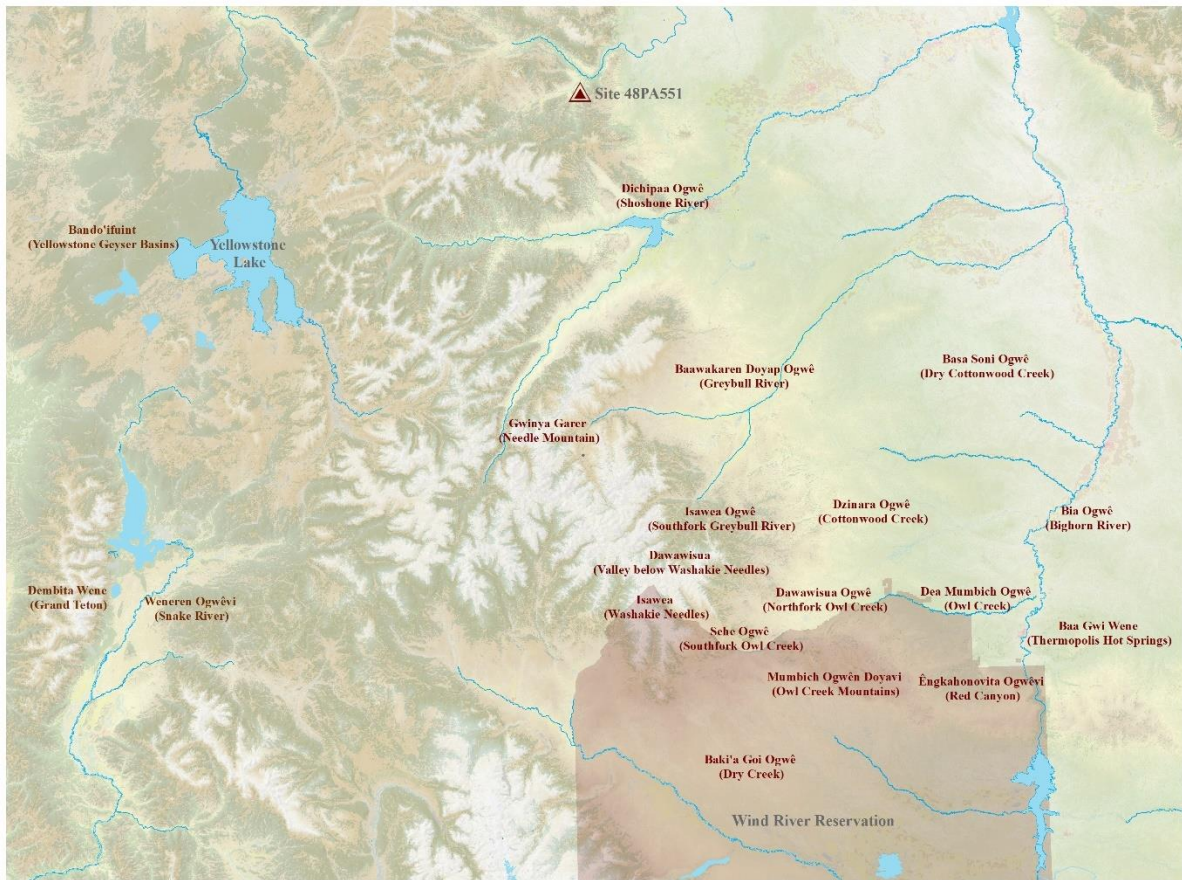


Figure 2: Map of northwest Wyoming with traditional Eastern Shoshone placenames (based on Shimkin 1947)

Prior to the establishment of the Wind River Reservation the Eastern Shoshone would seasonally travel across the landscape. Seasonal mobility patterns were developed, with smaller, optimal groups separating at certain seasons during the year. This population dispersal was described by Eastern Shoshone Elder, Curtis Barney, who grew up immersed in the traditions of his tribe. He learned from traditional knowledge holders, elders, and family members, knowledge was passed onto him through experiential learning and in the oral tradition. Logistical mobility patterns were employed in the winter and into early spring, the larger group would disperse into small bands and travel to various locales that may have included the Northern Platte, Bighorn Basin, Wind River Valley, Yellowstone, and the Absaroka Mountains. Habitation in winter

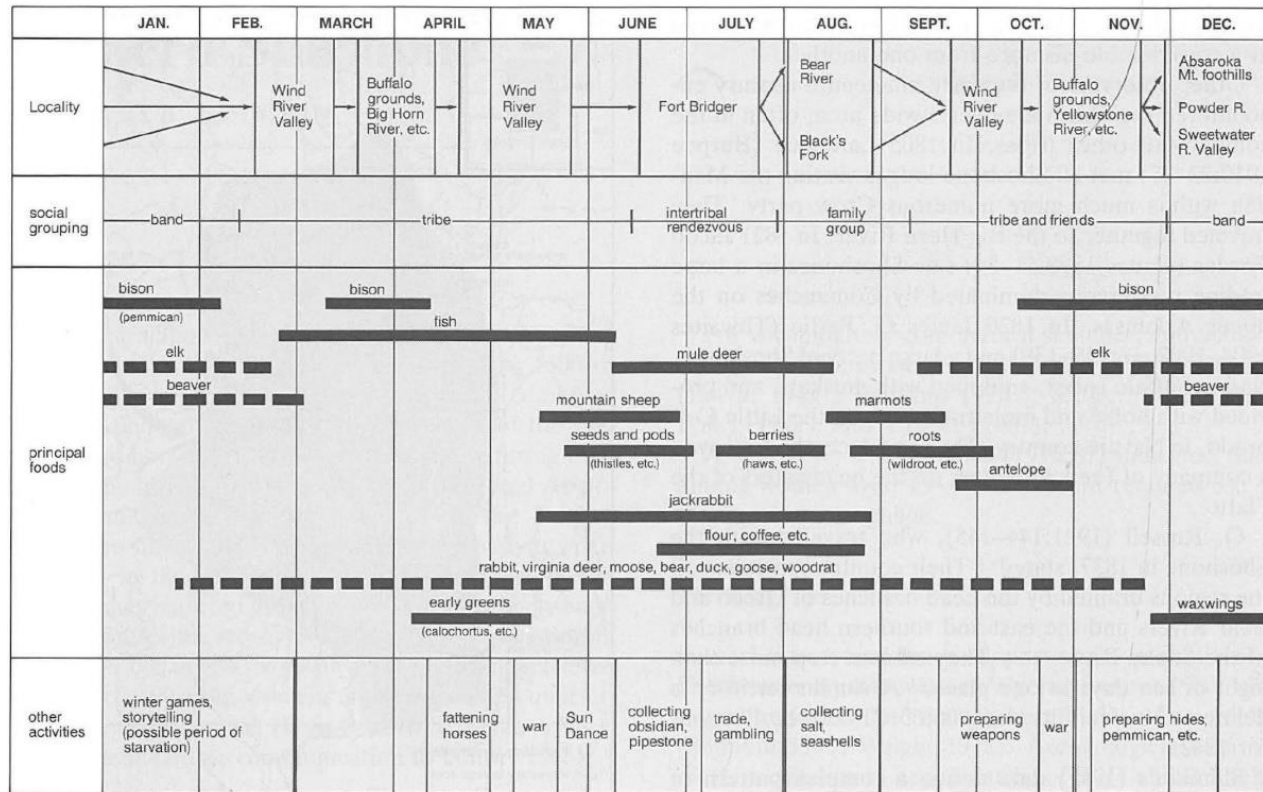


Figure 4: Interpretation of the annual subsistence rounds of the Eastern Shoshone (Shimkin 1947)

Traditional ecological knowledge has been developed through years of trial and error, experiential knowledge, observations, and connections to the environment. Seasonal migration patterns are merely one component of the TEK of the Eastern Shoshone (Figure 4) that were developed through observations of seasonal changes and food source availability. Limited access following the formation of the Wind River Reservation have led to the loss of crucial cultural knowledge, including resource management strategies and cumulative environmental knowledge adapted to generational environmental change. Passing down this type of experiential knowledge faces difficulties without the curation of deep relationships with specific locations. During interviews with Curtis Barney (2018) the loss of cultural connection, especially among tribal youth was a reoccurring theme. He primarily discusses the education system of the Eastern Shoshone youth; they were raised in schools that only teach from the Western perspective and

not in the Eastern Shoshone worldview “if they are not associated with cultural knowledge, they won’t know what to protect” (Curtis Barney, personal communication, April 26, 2018). The inclusion of Eastern Shoshone TEK in this research seeks to begin to restore cultural continuity to the Sunlight Basin landscape. Contemporary and past ethnographic research paired with paleoethnobotanical analysis can be used as tools to complement and uplift these knowledge bases.

Culturally important dietary plants to the Eastern Shoshone have been documented (Hill 2005; Moerman 1998; Renaud 2004; Shimkin 1947; Teran, et al. 2008) in multiple publications. Shimkin (1947) observed and documented the uses and Eastern Shoshone names of over 70 plants during the 1930s and 1940s. In the confines of Yellowstone National Park, Grand Teton National Park, and the National Elk Refuge, 156 plants traditionally used by the Eastern Shoshone were identified (Teran, et al. 2008). These sources both include comprehensive representation of plants traditionally used by the Eastern Shoshone across the GYE. This research highlights seven dietary plants traditionally used by Eastern Shoshone. These seven plants have been identified in the Sunlight Basin of northwestern Wyoming and in close proximity to archaeological site 48PA551; 1) **sogo goe zee nah** (*Claytonia lanceolata*), 2) **gu we zap** (*Lomatium* spp.), 3) **yahmb** (*Perideridia gairdneri*), 4) **doy yah oh hah gahn** (*Balsamorhiza sagittata*), 5) **bo gamp/gweh she bo gum** (*Ribes americanum*), 6) **zee yahm p** (*Rosa woodsii*), and 7) **yoo ry wongkovi** (*Pinus flexilis*). The selection of these seven plants (Table 1) hinged on four factors: 1) plants were traditional used by the Eastern Shoshone; 2) plants were identified in historic and contemporary ethnographic literature; 3) plants are located in the regionally to 48PA551; and 4) plants provide varied sources of dietary value.

Table 1: Eastern Shoshone plant names and uses (Shaul 2012, personal communication 2018, Teran 2008)

Scientific Name	Eastern Shoshone Name	Translation	Common Name	Dietary Use
<i>Claytonia lanceolata</i>	soe goe zee nah	earth potato	springbeauty	USO
<i>Lomatium</i> spp.	gu we zap	wild parsnip	biscuitroot	USO
<i>Perideridia gairdneri</i>	yahmb	wild carrot	yampah	USO
<i>Balsamorhiza sagittata</i>	doy yah oh hah gahn	mountain yellow	arrowleaf balsamroot	seeds/USO
<i>Ribes americanum</i> <i>Ribes setosum</i>	bo gamp / gweh she bo gum	down feathers berry	black currant /gooseberry	fruit
<i>Rosa woodsii</i>	zee yahm p	blossom	wild rose	fruit
<i>Pinus flexilis</i>	yoo ry wongkovi	limp pine	limber pine	nuts

Seeds, fruits, and underground storage organs (USOs) are produced by these plants and would have been used in the past for dietary purposes. The macrobotanical analysis of sediment samples from 48PA551 through flotation can identify carbonized seeds, while the microbotanical analysis of starch granules can identify carbohydrate dense foods associated with USOs. Four of the seven plants of focus are geophytes, a term applied to plants with enlarged taproots, corms, tubers, bulbs, or rhizomes that store carbohydrates and water (Adams 2010:86). These traditionally used geophytes were strategically chosen based on past archaeological documentation of abundant groundstone processing tools (Frison 1984) and the possibility of uncovering others in situ to be analyzed for starch granule residue. Such analysis can further contextualize the Middle Archaic Period, McKean Complex of site 48PA551, and is especially relevant when considering the McKean Complex may be representative of an increased focus on intense plant processing activities. This can also contribute to the reconnection of the Eastern Shoshone to landscapes that were inhabited prior to the reservation era.

SEVEN TRADITIONAL DIETARTY PLANTS



Figure 5: *Claytonia lanceolata* field sample

Claytonia lanceolata (Figure 5), commonly referred to as spring beauty is a delicate perennial herb with smooth, fleshy corms 5-20 mm in diameter. Plant stems stand erect at 5-20cm, with one to several flowering stems. The plant consists of 1-6 basal leaves petiolate, which are often absent at flowering (SEINet). The stem has two stalkless leaves that are attached directly to the base and are opposite. There are usually several saucer-shaped flowers that are 8-14mm in diameter, generally with 5 white to pink petals

with shallow notches at the tips and dark pink or purple veins on the upper surface (Tilt 2015:193). Flowering occurs from May to June. Plants prefer cool moist soils and are common in sagebrush communities to alpine slopes. Plants are commonly found on warmer slopes where snow accumulates and flower where snow has recently melted. The Eastern Shoshone name for this plant is **soe goe zee nah** (Teran, et al. 2008:28), which translates to earth potato (Shaul 2012:216). This is an important food source and one of the first plants to be harvested in early spring (Hart 1976:29). The crisp tuber like corms of the plant could be eaten raw or cooked; boiled or roasted like potatoes. The corms were also oftentimes buried fresh in underground caches, to be stored for winter use (Moerman NAED).



Figure 6: *Lomatium cous* (BLM OR050)

Lomatium spp. (Figure 6), commonly referred to as biscuitroot is a perennial aromatic herb one to four feet in height with a tuberous or woody taproot. This plant is a member of the parsley family. It has hollow stems and fern-like leaves that are

primarily basal; leaf blades are 8 to 25 cm long, broadly ovate, and 3 to 4 times pinnately divided (Lesica et al. 2012: 369). Flowers are arranged in dense, compound umbels, with no calyx lobes and petals are primarily yellow or white, but sometimes red or purple (Tilt 2015:37). There are approximately 15 variable species native to Wyoming that are difficult to differentiate. Many of the species were utilized as a food source, in much the same way. The Eastern Shoshone name is **gu we zap**, meaning wild parsley (Shimkin 1947:275). This is a staple food for Native Americans in the Rocky Mountain Region. Roots were dug in early spring, following the bloom, usually in early May. *Lomatium ambiguum* and *Lomatium simplex*, spring roots were pulverized and reduced to flour. *Lomatium dissectum* and *Lomatium cous* were eaten raw or roasted. The roots of *Lomatium macrocarpum*, were sun dried and stored for future use. Roots were pulverized, moistened, partially baked and made into cakes, gruel, and mixed with water and eaten as soup (Moerman NAED).



Figure 7: *Perideridia gairdneri* field photo

Perideridia gairdneri (Figure 7), commonly referred to as yampah is a perennial herb that emanates from tuberous roots that grow singly or in clusters of 2 to 3, 15 to 40 to 100 centimeters tall. Basal blades are divided 1 to 2 times pinnately into 3 to 5 pairs that form many, narrow subdivided lobes. Smaller leaves are found along the stem and are less often divided (Natural History Museum of Utah). Flowers are arranged in compound umbels. Peduncles from 3 to 20 centimeters with 8 to 13 bractlets and 15 to 40 white ray flowers (Tilt 2015:41). Fleshy, rounded fruits are

2.5 to 3.5 mm in length with thread-like ribs. Blooming occurs during July to August. This plant

grows on dry to moist slopes in meadows, subalpine and alpine forests below 3000 m in elevation. The Eastern Shoshone name for this plant is **yahmb** (Teran, et al. 2008:28), meaning wild carrot (Shaul 2012:247). The dense, tuberous roots of this plant have a sweet nutty flavor, similarly to a domestic carrot. The root serves as an important carbohydrate source for both people and animals. The roots are harvested in the spring using digging sticks and can be eaten raw, roasted, boiled, or dried for storage through the winter (NHMU). One method for preservation for winter use includes boiling and smashing roots to make small, round cakes that can be sun dried (Hart 1976:65).



Figure 8: *Balsamorhiza sagittata* field photo

Balsamorhiza sagittata (Figure 8), commonly referred to as arrowleaf balsamroot is a large-leaved perennial herb from a large taproot and simple or branched caudex that ranges from 8 to 36 inches in height (Lesica et al. 2012:505). Leaves mainly basal and arrow shaped, often reach up to 4 inches in width and 6 to 9 inches in length. When young the leaves have felt-like wooly hairs, giving the plant a velvety-gray appearance (Tilt 2015:58). Plant has long stalks that are silvery-green in color with large and showy, mostly solitary heads with yellow-rayed and disk-shaped flowers at ends of stem (Shaw 1976:56). In bloom from April to June. Habitat includes open hillsides and prairies from 4300 to 5900 feet in elevation among sagebrush scrub, juniper woodland, and yellow pine forest communities (NHMU). The Eastern Shoshone name for this plant is **doy yah oh hah gahn** meaning mountain yellow (Teran et al. 2008:24). It was utilized as a reliable food source in a variety of ways. To make them more palatable the woody roots were roasted in fire

pits for days. Seeds could also be eaten, much like sunflower seeds or be ground into flour and mixed with grease for consumption (Hart 1976:20).



Figure 9: *Ribes setosum* field photo

Ribes americanum and *Ribes setosum* (Figure 9), erect to spreading shrub with armed or unarmed spineless stems.

Twigs are covered with short black hairs, are sessile, with yellow glands, and gray to black bark. Leaves blades are 1 to 7 cm wide and alternate with 3 to 5 lobes, palmately veined (Lesica et al. 2012:244). This plant bears 6 to 12 green to white flowers that are 6 to 10 mm long in showy raceme.

Flowers are arranged in erect clusters that are broadly funnel shaped, with 5 spreading petals and 5 spreading sepals (Tilt

2015:324). The fruit is a many seeded berry, generally crowned with persistent floral parts. The unarmed species (*Ribes americanum*) is commonly referred to as black currant and the armed species (*Ribes setosum*) is commonly referred to as gooseberry (Shaw 1976). The Eastern

Shoshone name for the black currant species is **bo gamp** while the name for gooseberry is **gweh she bo gum**, translating to down feathers berry (Shaul 2012:239). The gooseberry name was included with that of the black currant because in the historic literature they often overlapped and were interchanged. The fruit of both of these plants were highly regarded and used in a similar way, dietarily (Native American Ethnobotany). The berries could be eaten raw, dried for future use, and made into cakes; pemmican, with fats and other vital food sources.



Figure 10: *Rosa woodsii* (BLM NV040)

Rosa woodsii (Figure 10), commonly referred to as wild rose is a deciduous shrub 1 to 3 meters in height and thicket forming. Stems are armed or unarmed covered with fine prickles as well as larger ones with straight or curved nodal prickles (Lesica 2012:285). Leaves are alternate, odd-pinnate and divided into 5-9 toothed

leaflets. 6 to 7 leaflets are alternate on the stems, 2-5 cm long and range in shape from oval to elliptic (SEINet). Flowers are abundant and pink with 5 showy petals. The floral cup that the flowers surround becomes enlarged, enclosing achenes (dry fruit that tightly encases one seed) in a fleshy, red to orange fruit, commonly referred to as a rose hip (NHMU). Flowering from May to July, this plant is common in moist settings, but is adapted to a variety of habitats including open forest, woodlands, riparian thickets, snow-catchment areas of grasslands. The Eastern Shoshone name for this plant is **zee yahm p** (Teran, et al. 2008:27). The rose hips are a good source of vitamin C and can be made into jelly, syrup, and tea. The hips could also be consumed out of necessity during the harsh winter months, since the hips remain on the bush for much of the winter (Hart 1976:62).



Figure 11: *Pinus flexilis* (BLM WY040)

Pinus flexilis (Figure 11), commonly referred to as limber pine is a shrubby evergreen tree reaching about 15 meters tall. Ascending branches and flat-topped crowns resemble broad-leaved trees. Crowns are conical when tree is young and become rounded or flat-topped with age. Older trees have bark that is usually furrowed and plated, plates and ridges are layered or scaly.

Branches are usually in pseudo whorls, with both long and short shoots (SEINet). Leaves are needle-like, in groups of 2 to 5 on nubbin-like spur shoots that are subtended by sheathing scale leaves at the base. The twigs of this tree are very flexible, giving rise to the species name. Pollen cones densely cluster at the base of current year's growth. Seed cones are ovoid to cylindric and mature the second year, opening at maturity. Cones are 8 to 18 cm long with no prickles. Scales of the cone are numerous, woody, spirally arranged, and often have a thickened tip. There are 2 seeds per scale. Unlike *Pinus albicaulis* (whitebark pine), the cones of *Pinus flexilis* open, drop their seed, and then fall intact. It is not unusual to see a carpet of old cones beneath mature trees (Lesica 2012:77). These trees can inhabit some of the driest sites capable of supporting trees, but primarily grow in open and dry environments such as exposed rocky mountainsides, montane to tree line (Tilt 2015:333). The Eastern Shoshone word is **yoo ry wongkovi**, meaning limp pine (Teran, et al. 2008:26). The large seeds/pine nuts of this tree are a very important article of food because of their high fat and protein content. The seeds could be eaten cooked, raw, ground into a flour, or stored for future use.

CHAPTER 4: COLLABORATIVE FRAMEWORK

I strongly believe that the future health and vitality of the field will depend on an inclusive, collaborative kind of archaeology [Lightfoot 2008].

The premise of this study is underpinned by two distinct, but related collaborative approaches to archaeological research. The paradigms of both Indigenous Archaeology and Landscape Archaeology encompass the idea of critical multivocality (Atalay et al. 2014). Collaborative in conception, these approaches provide the appropriate framework for the inclusion and collaboration with and between various perspectives and worldviews. Both Indigenous Archaeology and Landscape Archaeology allow for a richer contextualization of the archaeological record, for a further understanding of the people and environments of the past.

INDIGENOUS ARCHAEOLOGY

The Indigenous Archaeology paradigm, “archaeology done with, for and by Indigenous people” (Nicholas and Andrews 1997:3) begins to emerge following the creation of Indigenous heritage programs in the 1970s and the subsequent enactment of the Native American Graves Protection and Repatriation Act (NAGPRA) and amendments to the National Historic Preservation Act (NHPA), establishing Tribal Historic Preservation Offices (THPO) in the early 1990s (Nicholas and Andrews 1997). This approach to archaeological research grows from the acknowledgement that the primary control of Indigenous histories and identities has been in the hands of archaeologists and appropriated solely as scientific data (Colwell and Ferguson 2007). Nicholas (2008) provides a comprehensive definition of the Indigenous paradigm as:

Indigenous Archaeology is an expression of archaeological theory and practice in which the discipline intersects with Indigenous values, knowledges, practices, ethics, and sensibilities, and through collaborative and community-originated or -directed projects, and related critical perspectives. Indigenous Archaeology seeks to make archaeology more representative of, relevant for, and responsible to Indigenous communities. It is also about redressing real and perceived inequalities in the practice of archaeology and improving our

understanding and interpretation of the archaeological record through the incorporation of new and different perspectives [Nicholas 2008:1660].

Indigenous Archaeology gives agency to communities, the ability to take a leading role in the protection, management, and study of their own heritage (Silliman 2008:230). Indigenous Archaeology is not simply archaeology done by Indigenous peoples, but a tool to break down and examine power structures within archaeological research, as well as colonialist interpretations of the past. Indigenous communities are essential keys to understanding past cultural phenomena and must be involved in the entire process of archaeological inquiry, not just the finished product (Watkins 2011). One need not be a member of an Indigenous community to follow an Indigenous paradigm and promote archaeological endeavors that are part of a decolonizing practice centered on the goals of Indigenous communities, and implements methods and practices that are in line with Indigenous worldviews, traditional knowledges and lifeways (Atalay 2006:284). Indigenous Archaeology is contingent on archaeological scholars directly collaborating with stakeholders whose heritage is under study; “archaeological practice and the knowledge it produces are part of a history and heritage of living people and have complex and contemporary implications and relevance for those people in daily life” (Atalay 2006:283). This inclusive practice often includes people of different backgrounds, cultures, and perspectives who share a common interest in the archaeology of a particular place (Lightfoot 2008:214). Collaboration includes that acknowledgment of biases that may perpetuate the notion that Western science is superior to Indigenous knowledge, by promoting traditional knowledge bases and Indigenous life experiences. The knowledge of Indigenous communities and those of Western science are distinct, yet complimentary. These two perspectives can be unified for stronger, more holistic, collaborative archaeological research.

Collaboration provides a way to account for and begin to remedy the past actions, with the hopes of restoration to cultural continuity through the integration of archaeological data, ethnographic studies, historical documents and oral histories (Murray 2011:36). Atalay (2012) develops a framework of collaboration between Indigenous communities and archaeologists called community-based participatory research (CBPR). This collaborative approach provides a method for specific communities and archaeologists to work together to pursue research questions that benefit them both as equal partners. The community-based participatory research method involves a continual loop of engagement where community members and archaeologists collaboratively define questions, methods, and outcomes of a project. Advantageous partnerships between archaeologists and Indigenous communities can be developed to facilitate the collaboration amongst diverse knowledge systems, fostering reciprocal benefits, and empowering communities that have been disempowered historically (Colwell 2016:116). Collaborative processes, fostered by the paradigms of Indigenous Archaeology, ‘braids’ knowledge from various perspectives, worldviews, and disciplines through ‘critical multivocality.’ Within the framework of Indigenous archaeology numerous perspectives and values are brought together in unison to enlarge our shared understanding of the past (Atalay et al. 2014:11-12).

The formation of archaeological research questions and methodologies have much to gain from the inclusion of various perspectives to further understand past human behavior and connections to the environment. The use of archaeological data, environmental data, ethnographic work, historical documents, oral histories, and traditional knowledge in collaboration with each other offer Indigenous communities and archaeologists a much more thorough interpretation of the processes of cultural change, human behavior, utilization of the

natural environment, and connections to the landscape. Indigenous Archaeology serves as a platform for this collaborative research with the Eastern Shoshone community. Working toward multi-vocality, contemporary interviews with Eastern Shoshone Elder, Curtis Barney were conducted, along with the ethnographic, paleoethnobotanical, and archaeological analyses. These multiple lines of evidence from various perspectives are employed to investigate the long-term human-environmental relationships in the Sunlight Basin during the McKean Complex, specific to archaeological site 48PA551. Along with the framework of Indigenous Archaeology, Landscape Archaeology is also implemented into this research. Landscape Archaeology hinges on cross-cultural communication and collaboration with Indigenous communities, specifically to the traditional construction and reproduction of meaningful places, community associations, and identities upon the landscape (Anschuetz, Wilshusen, and Scheick 2001).

LANDSCAPE ARCHAEOLOGY

In the settler mind, land was property, real estate, capital, or natural resources. But to our people, it was everything: identity, the connection to our ancestors, the home of our nonhuman kinfolk, our pharmacy, our library, the source of all that sustained us. Our lands were where our responsibility to the world was enacted, sacred ground [Kimmerer 2013:17].

Landscape Archaeology studies the complex interactions between humans of the past and their environments, to understand how people of the past built up social environments through interactions with nature. This approach focuses on the ways humans actively embed meaning and memory via the spatial, historical, and social dimensions of human-nature relations, onto the natural environment. These landscapes, as material culture, inherit properties, performance characteristics, life histories (Zedeño 2000:98) and serve as mnemonic devices to recall memories and social interactions that occurred in places, while also legitimizing present relationships. The interconnected network of meaningful places across space are created from the

dynamic relationships between humans and the natural environment is referred to as a cultural landscape (Anschuetz, Wilshusen and Scheick 2001). The natural environment and cultural landscapes are distinct but are intrinsically interconnected in the tangled web of the physical environment, social structures, and individual experiences (Pauls 2006).

Early investigations into human-environmental interactions were primarily concerned with adaptive human behaviors to specific environmental settings. Landscape Archaeology is a direct critique of environmental determinism (Hirsch 1995) and moves away from these principles and begins to discuss the ways in which humans exert agency through purposeful alterations of their environments in the construction of cultural landscapes. The growing interest in a more socially oriented Landscape Archaeology is argued by David and Thomas (2008) to have been influenced by the implementation of new types of sourcing studies, the rising importance of cultural heritage management and public archaeology, and Indigenous critiques. The conceptual framework of Landscape Archaeology enables archaeologists to address human pasts in all of their contexts, accounting for conscious human actions, dynamic cultural processes, and ontological perceptions; “it concerns not only the physical environment *onto* which people live out their lives but also the meaningful location *in* which these lives are lived” (David and Thomas 2008, 38).

The inclusion of Indigenous communities in collaborative efforts were not immediately utilized in archaeology. These key components of Landscape Archaeology arise only after the framework of a regional scaled, human-environmental relationship focused research was underway. Earlier archaeologists pave the way for Landscape Archaeology. The early work of Grahame Clark under his functionalist approach began to focus on how humans lived in the past through the reconstruction of economic structures, social and political organization, and systems

of beliefs as one collective functioning system (Trigger 2006, 353-354). The settlement archaeology of Julian Steward sought to understand the role ecological factors played in altering prehistoric socio-cultural systems by focusing not only on the stylistic analysis of artifacts, but on the archaeologically observable changes to settlement patterns, population size, and subsistence economies (Trigger 2006). The goal was to study human-environmental interactions in relation to behavior and cultural change. The work of Gordon Willey in the Virú Valley of Peru, along with the advancement of aerial photography technologies and large ground surveys allowed for broad regional documentation of archaeologically significant places across the landscape. Willey and his team located and document 315 prehistoric settlement sites and irrigation systems across approximately 350 sq. km (Anschuetz, Wilshusen and Scheick 2001, 169). Studies of settlement patterns on this scale allowed for a glimpse of the regional diversity amongst cultures and a view of the spatial complexities of culture change across the landscape (Trigger 2006).

Following the work of Steward and Willey, Binford (1964) introduces probability sampling as a productive method of operationalizing the distribution of artifacts in space. Instead of simply observing the geographical location of a set of artifacts, this technique attempts to understand the variance in the distribution of artifacts across space and examine changes (Dunnell and Dancey 1983). Humans of the past were not constrained by the arbitrary site boundaries that archaeologists create, but lived out their lives in, between, and around “sites,” suggested by evidence of natural resource procurement, artifacts, subsistence strategies, and mobility patterns. Dunnell and Dancey (1983) implement their own regional scaled methodology, the siteless survey. They see archaeology’s preoccupation with the strict definition of “site” and subsurface excavation to be a hinderance to regional scaled data collection. They

argue for surface survey over larger areas and tabulation of land use, settlement patterns, ecological adaptation, resource utilization, and distributions of artifacts. This process acknowledges that “distinguishing a site and setting its boundaries is an archaeological decision, not an observation” (Dunnell and Dancey 1983:271). The implementation of alternate sampling and survey methods leads to a shift from settlement patterns, to a concentration on whole settlement systems, inclusive of how people were organizing themselves across space. Binford focuses on the organizational and spatial relationships within specific environmental niches by identifying the “long-term repetitive patterns in the “positioning” of adaptive systems in geographic space” (Binford 1982:6). The strictly materialistic approaches to studying people of the past lacks an emphasis on the symbolic meanings, and memories that are embedded within cultural landscapes.

Much like the paradigm of Indigenous Archaeology previously discussed, Landscape Archaeology relies on collaboration and the contributions of various perspectives. Zedeño (2000) describes two key differences in perspective the “space-bound,” nuclear, and intensive land tenure system of early settlers and “place-bound,” extensive, mobile systems hunter-gatherers have maintained throughout time. Indigenous groups occupation of vast landscapes and “conceptualization of land did not fit the notion of bounded space as a discrete geopolitical entity” (Zedeño 2000:99). The studies of landscapes as cultural resources themselves is expanded with the integration of ethnographic, archaeological, and ethnohistorical research in the evaluation of traditional cultural properties (TCPs). The term TCP is introduced in National Register Bulletin 38 (Parker and King 1990:1) as a property that is eligible for inclusion in the National Register of Historic Places (NRHP) based on its associations with the cultural practices, beliefs, lifeways, or social intuitions of a living community that are both rooted in that

community's history and are important in maintaining the continuing cultural identity of the community. The acknowledgement of landscape frameworks through the notion of TCPs promotes and accepts archaeological research that works to understand cultural landscapes, along with the boundaries that confine the designation of TCPs or TCDs (traditional cultural district). Zedeño (2007) works with the Blackfoot Tribe in cultural landscapes that have not been formally included in the Badger-Two Medicine Traditional Cultural District

The inclusion of the perspectives of Indigenous communities is at the core of Landscape Archaeology (Guilfoyle et al. 2013; Zedeño 2007). Only through the discussion of these places with the communities that value them can archaeologists and anthropologists grasp the culturally specific reasons why places hold value (Teeman 2008). A given place is socially and culturally constructed, the value of a place goes beyond the mere geographic location of vital water sources and natural resources that are provided by the environment, the memories and social interactions that have occurred there must also be included (Basso 1996). Integral to effective Indigenous cultural heritage management is the “protecting and managing both the physical fabric of places and landscapes, as well as the associated values related to community-identified social and cultural activity” (Guilfoyle et al. 2013, 102-103). Landscape Archaeology as an approach attempts to encompass understandings of land and boundaries of Indigenous communities, distinct from strictly western ideologies about bounded space. The framework of Landscape Archaeology provides a method in which past human behavior variability can be accessed in the archaeological record, observed, and investigated in a context that transcends the limits of specific geographic locations and arbitrary site boundaries.

CHAPTER 5: HYPOTHESIS AND EXPECTATIONS

The primary research questions of this study address how archaeological research can be enhanced by the inclusion of the traditional ecological knowledge of local and Indigenous communities. Additional perspectives can shed new light on the way research questions are formulated. The Sunlight Basin Archaeological Project (Figure 12) established three distinct hypotheses and test expectations following geophysical survey in 2017 and prior to archaeological excavations during the 2018 field season (Prentiss 2019; Prentiss et al. 2017).

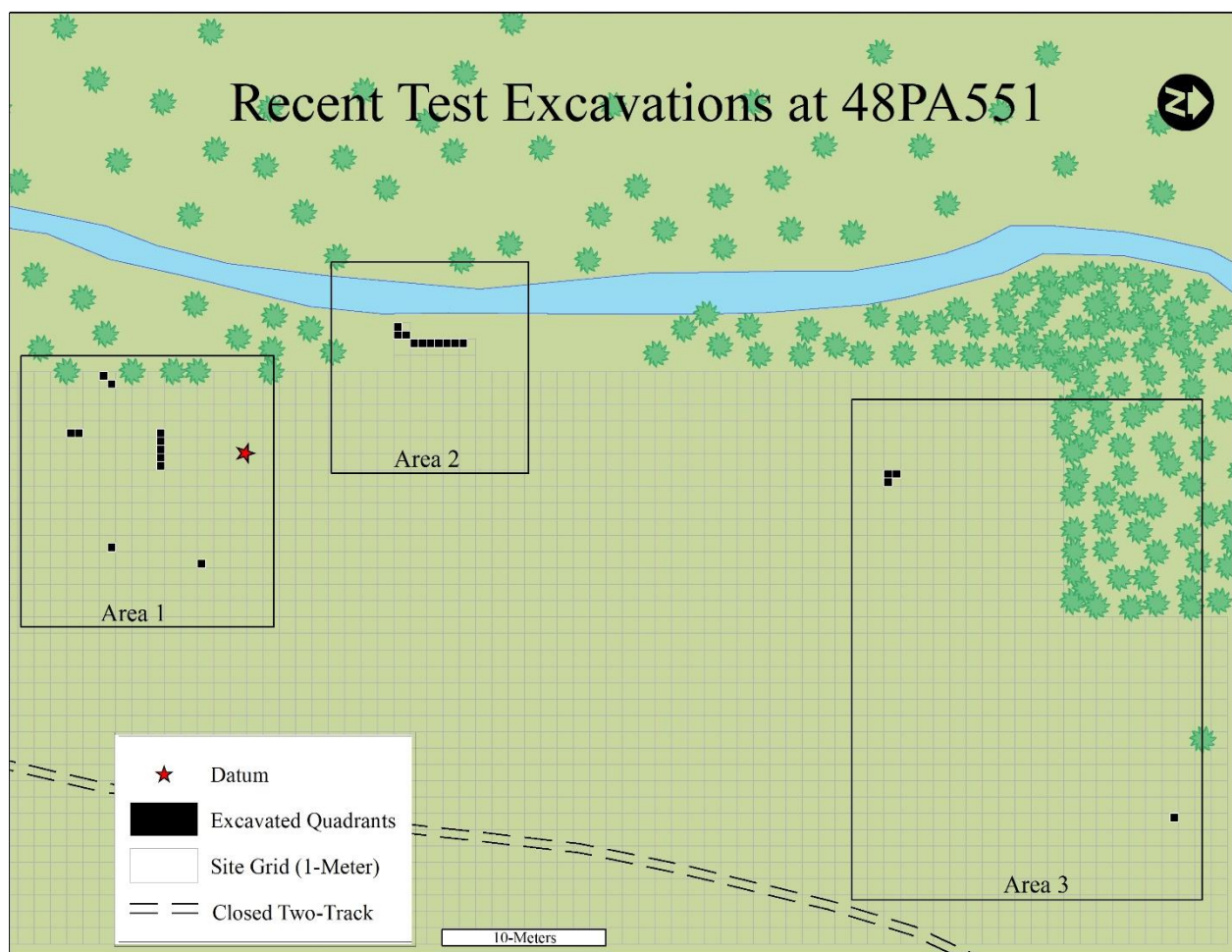


Figure 12: Site Map of 2018 Excavations at 48PA551

These hypotheses are concerned with the Middle Archaic, McKean Complex at site 48PA551, specifically the subsistence and settlement strategies that are exhibited within these occupations. The following three hypotheses were presented by Prentiss (2019):

Hypothesis 1) The McKean Complex represented at 48PA551 was a terminal extension of the residentially mobile desert-adapted foraging strategy developed during the Early Archaic as particularly expressed in the many sites as clusters of small housepits. McKean Complex peoples visited select portions on the landscape for relatively short residential periods, living in small groups, foraging for local resources, but not engaging in significant food storage.

Hypothesis 2) The McKean Complex represents an altered desert foraging adaption more greatly resembling the Pithouse I culture on the Columbia Plateau to the Northwest in developing semi-sedentary occupations in resource rich ecotones permitting them to forage for shifting resources seasonally while avoiding significant investment in food storage; no evidence of cache pits or food processing. Plant foods consistent with multi-seasonal occupation.

Hypothesis 3) The McKean Complex represents a newly innovated socio-cultural strategy characterized by long term winter-sedentism and the extensive use of logistical organization for acquiring particularly abundant local and more distant food resources. Given logistical organization and resource targeting storage is expected to have been important. Food storage is expected in the form of cache pits and evidence of plant and animal processing for storage. Plant foods should indicate late summer to fall plant foraging [Prentiss 2019].

The research questions specific to this project were influenced by these preliminary hypotheses posed about the McKean Complex occupations. This thesis is distinct in that it is framed within the post-processual frameworks of Indigenous Archaeology and Landscape Archaeology, while strictly focusing on the implementation of Eastern Shoshone traditional plant knowledge and paleoethnobotanical analyses further inform and contextualize cultural connections and past human habitation strategies at 48PA551. How can Eastern Shoshone TEK inform interpretations of intensive dietary plant harvesting and processing during the McKean Complex at 48PA551?

HYPOTHESIS

The McKean Complex of the Middle Archaic Period is widely discussed amongst archaeologists as characterized by use of various microenvironments for broad foraging patterns and intensive plant processing strategies. The archaeological record and new investigations at 48PA551 lend itself to test the notion that there was heightened focus on plant food consumption and processing during the McKean Complex. This calls for the further investigation into the human-environmental relationships during this time period. The traditional plant knowledge of those communities who once made use of this landscape, specifically the Eastern Shoshone, and paleoethnobotanical analyses provide further insights into past subsistence strategies and settlement patterns.

The implementation of TEK and paleoethnobotanical analyses can enhance past and present archaeological investigations, and in turn, the archaeological evidence can support the TEK of Indigenous communities. This is done through 1) a shift in perspective, to create different research questions to understand plant use from an Indigenous worldview; 2) the implementation of paleoethnobotanical methods to analyze groundstone and other artifacts that may have been used in intensive plant processing; 3) the analysis of past ethnographic documentation specific to Eastern Shoshone traditional plant use; and 4) conducting landscape survey of native and traditionally used plants still located in the vicinity of 48PA551. Archaeological investigations at 48PA551 are improved by the utilization of a multi-perspective approach to research to better contextualize excavated archaeological material specific to plant use, food procurement, settlement strategies during the Middle Archaic, McKean Complex. These four components are not necessarily separate, but instead identify the ways collaboration

with Indigenous communities and implementation Indigenous ideologies can enhance interpretations concerning human activities of the past.

TEST EXPECTATIONS

It is expected that the three overarching hypotheses (Prentiss 2019) put forth by the Sunlight Basin Archaeological Project will be enhanced by the addition of Eastern Shoshone plant knowledge because of the increased importance of plant gathering and processing during the McKean Complex. This research provides another line of evidence to support the proposed hypotheses and when combined with archaeological evidence can enhance the interpretation of subsistence strategies. The test expectations, specific to plant food use and storage for Prentiss' hypothesis are as follows:

Hypothesis 1 Test Expectations

- Limited evidence of food storage, small to moderate sized cache pits with seeds could be present.
- Subsistence remains would reflect relatively broad diet.
- Immediate return/search structured foraging. Seasonally specific plant foods.

Hypothesis 2 Test Expectations

- Lack of evidence of food storage, no cache pits or food processing indicators.
- Broad diet – long term occupation facilitated by acquisition of food sources from multiple microenvironments.
- Plant foods consistent with multi-seasonal occupation

Hypothesis 3 Test Expectations

- Evidence of food storage in form of cache pits and/or plants and animals processed for storage.
- Plant foods should indicate late summer to fall plant foraging

This research is in conjunction with the Sunlight Basin Archaeological Project, but retains distinct hypotheses and expectations related to the inclusion of traditional dietary plant

knowledge of the Eastern Shoshone. Ethnographic interviews and analysis of historic ethnographic documentation can determine what types of plants were being used, what time of year they were collected, and how they were being processed. This knowledge will inform archaeological materials from past and current excavations related to plant processing activities; hearth and storage features, groundstone tools, etc. I expect that past and present archaeological evidence, including recent paleoethnobotanical analysis, ethnographic research, and plant surveys can support traditional knowledge of native plants still present on the landscape. I argue that if the plants identified 1) are species native to this region of northwestern Wyoming; 2) were historically recorded in the region; 3) are recovered from archaeological excavations and analyses; and 4) have documented in name and usage in the Eastern Shoshone lexicon that these plants were important food sources, managed and processed by humans in the past.

CHAPTER 6: ETHNOGRAPHIC, BOTANICAL, AND LABORATORY METHODS

The methodologies implemented in this research emphasizes the fluid construction of interpretations throughout the archaeological process, the critical importance of context for generating archaeological meanings, and employing the knowledge of various specialists: tribal elders, botanical specialists, and archaeologists. Such methodologies provide the platform for this collaborative research to present multiple sources of information and multiple interpretations side by side. This section discusses the methodologies behind interviews, ethnographic document analysis, field survey, and paleoethnobotanical analysis. These methodologies offer room for each of these distinct knowledge sources to be compared and contrasted to “construct much richer and deeper nuanced historical narratives that take into account multiple voices and viewpoints” (Lightfoot 2008:224). Through this methodology the integration of archaeological data, ethnographic studies, historical documents and oral histories enhance the understanding of the Sunlight Basin and site 48PA551.

ETHNOGRAPHIC DOCUMENT ANALYSIS

This research analyzes past ethnographic documentation focused on the traditional plant knowledge of the Eastern Shoshone Tribe. The published historic ethnographic works of Dimitri Shimkin (1947), along with primary source field notebooks from work with the Eastern Shoshone during the 1930s and 1940s will provide preliminary knowledge about the plants traditionally used by the Eastern Shoshone during this time. Relevant historic data concerning traditional plant use from the Shimkin documents was cataloged to include scientific plant names, Eastern Shoshone name and use, and English translations. Usage, meaning, and translations were also documented from contemporary ethnographic studies; Shaul’s (2012) National Science Foundation Documenting Endangered Languages (DEL) Project, Hill (2005),

Moerman (1998, and Teran (2008). The information gleaned from contemporary ethnographic studies was added to the working plant catalog as another category including updated scientific names and spelling corrections. This initial catalog of traditional and important plants to the was generated prior to conducting field plant surveys or ethnographic interviews with Eastern Shoshone elder Curtis Barney.

EASTERN SHOSHONE INTERVIEWS

Interviews were conducted with one tribal Elder, Curtis Barney in person on the Wind River Reservation, Fort Washakie, Wyoming and over the telephone. Prior to conducting these interviews, a research proposal was written about the extent of and goals of this project, and submitted to Joshua Mann, the Eastern Shoshone Tribal Historic Preservation Officer (THPO). Following this proposal Joshua Mann expressed interest in the project, along with Eastern Shoshone Elder, Curtis Barney. Next a project proposal was then submitted to the Eastern Shoshone Business Council (ESBC) for Tribal Council approval to conduct interview with interested Elders regarding the Sunlight Basin, Wyoming area. A research proposal was also submitted to the Institutional Review Board (IRB) at the University of Montana to ensure that this project presented minimal risks to human subjects involved in ethnographic interviews. This research was approved by both entities; ESBC and University of Montana IRB. Three separate interviews were conducted with Eastern Shoshone Elder, Curtis Barney, one all day interview in person and two shorter phone interviews. Each of these three interviews were documented with detailed annotations and transcripts compiled from audio recordings.

Preparation prior to interviews resulted in seven preliminary questions:

- 1) Are there traditional Eastern Shoshone place-names associated with the Sunlight Basin?

- 2) Why is the Sunlight Basin meaningful to the Eastern Shoshone?
- 3) How have the Eastern Shoshone people used this landscape in the past – and how is it presently used?
- 4) What plants were/are prevalent and valued by the Eastern Shoshone within the Sunlight Basin? Were these processed for storage? If so, how?
- 5) What animals were/are prevalent and valued by the Eastern Shoshone within the Sunlight Basin? Were these processed for storage? If so, how?
- 6) How is environmental knowledge implemented today and how has it changed over time? How has change in territory and climate change effected this knowledge?
- 7) How can reattaching traditional place-names of the Eastern Shoshone to cultural landscapes positively impact Eastern Shoshone people today?

Upon further review these preliminary questions were not used because they were too pointed and directive and would not allow for true collaboration or communication during interviews. These questions only served my own research by only asking what I wanted and needed to know. The goal of these interviews within a critical collaborative framework is to learn and to engage with dialogues from different standpoints, to consider multiple scenarios, and to scrutinize my own ideas (Lightfoot 2008:213). After rethinking the original interview questions, three open-ended questions were refined, primarily as a tool to spark a free form conversation and discussion about the traditional plant use of the Eastern Shoshone:

- 1) What plants were/are prevalent and valued by the Eastern Shoshone?
- 2) For overwintering, what plants would have been processed for storage?
- 3) How is environmental knowledge utilized today and how has it changed over time?

These questions highlight the focus of this research, but do not explicitly lead to expected answers. However, the questions were not explicitly asked during the in-person interview with Curtis Barney on the Wind River Reservation. Discussions focused more on a general conversation of traditional plant use of the Eastern Shoshone, examination of past ethnographic studies, and in the field plant identification. Over the course of the interviews Curtis Barney provided edits to Eastern Shoshone spelling, usages and provided pronunciation guidance to the preliminary catalog. These discussions were added and used to update the working plant catalog.

PLANT SURVEYS

Two plant surveys were conducted at site 48PA551 and surrounding areas. The first was a simple presence/absence plant survey that was conducted with the Shoshone National Forest Rangeland/Invasives Manager, Jason Brengle. This served to identify plants from the working plant catalog that are still present within the boundaries of site 48PA551 and nearby areas. The second plant survey was conducted with Elizabeth P. Johnson, Natural History Museum of Utah (NHMU), Garrett Herbarium botanist and Dr. Nicole Herzog, Associate Professor, Denver University who conducted the paleoethnobotanical analysis for this project. Plants from the working plant catalog were identified on the landscape. Some fresh specimens were collected from wild populations around the site for the Garrett Herbarium (Appendix A) and as comparative modern starch samples for the identification of archaeological starch granules. Two specimens from each plant were taken and the location of the collection was recorded (Figure 13). One specimen is strictly for the comparison between modern and archaeological starch grains and will lose integrity following the destructive starch granule analysis. The USOs of many of the starch rich plants were collected in this process. The other specimens were collected

to be curated in the herbaria collection at the NHMU Garrett Herbarium and were mounted, photographed, pressed in the field for this purpose. If a taxon could not be found in wild populations, dried materials from voucher specimens in the herbaria at the NHMU Garrett Herbarium were used for comparison. Modern starch grains were extracted from collected specimens for macro and microscopic examination. Such comparisons between modern and archaeological starch grains enabled taxonomic determinations.

Figure 13: Plant specimen collection locations near 48PA551

From the compiled catalog of ethnobotanically important plants of the Eastern Shoshone from historic documentation, personal communication with Curtis Barney, and plant surveys seven specific plants native to northwestern Wyoming were chosen (Table 1) to be the primary focus of this research. Plants were selected based on following four categories: 1) traditional

usage by the Eastern Shoshone; 2) identification in historic ethnographic literature; 3) regionally present near archaeological site 48PA551; and 4) provided varied sources of dietary value (seed, fruit USO) that could potentially be identified through macrobotanical and starch granule analysis. During field surveys all seven plants were identified as present within the region of the site, four within the immediate vicinity of 48PA551; *Lomatium spp.*, *Perideridia gairdneri*, *Ribes americanum*, and *Rosa woodsia*. See Chapter 3 for specific knowledge about plant structure, habitation, and growth patterns, as informed by Lesica (2012), Tilt (2005) and Shaw (1976). The combination of various lines evidence led to one cohesive catalog of ethnobotanically important plant foods of the Eastern Shoshone. This allows for the comparison of three distinct plant knowledge bases, to determine where this knowledge overlaps, in support of TEK and archaeological research.

MACROBOTANICAL AND STARCH GRANULE ANALYSIS

The 2018 archaeological research at 48PA551 conducted excavations to systematically test anomalies identified by during geophysical survey in 2017. The excavation was primarily focused on testing and collecting samples from hearth, roasting pit, and storage pit features within or outside of larger anomalies that could be representative of housepits (Prentiss et al. 2019:8). Test excavation units were 50 x 50 cm in diameter (Figure 12). For paleoethnobotanical analysis sediment samples, groundstone tools, and FCR fragments were examined from across 10 excavation units. Many of these samples and artifacts were excavated from archaeological features possibly associated with food storage/processing spaces. Four features were excavated at 48PA551 in 2018 (Table 2). Feature 1 is a moderately shallow bowl-shaped pit containing charcoal fragments but limited other cultural materials. The sparse charcoal, limited FCR, and

lack of sediment oxidation suggest a refuse disposal feature, instead of a hearth feature. Feature 2 has extensive charcoal fragments, abundant FCR, and sediment oxidation. This feature appears to be a hearth pit that may have been used for heating or roasting food, although no food remains were recovered during analysis. Feature 4 is a wide and deep vertical-sided pit (60 cm+ wide and 45 cm deep). It contains extensive charcoal but very limited FCR with no obvious sediment oxidation. The fill of the feature appears to be associated with processing and cooking activities, but due to the dimensions of the feature it may have served as some sort of storage feature at some point. Feature 5 is a very shallow bowl-shaped pit, with no evidence of FCR. The shape resembles a shallow hearth, which seems unlikely because of the lack of sediment oxidation. In addition to these features two housepit features were encountered during excavations and are describes as Strata III and Ia/IV (Prentiss et al. 2019:17-18).

Table 2: Features excavated at 48PA551 in 2018

Feature #	Unit	Stratum	Level	Excavated Volume (cm ³)	FCR	Charcoal	Type
1	1057 N 1023 E	I	1	13,734	5 (p) 0 (c)	yes	shallow pit
2	992 N 996 E	I	3	15,045	14 (p) 12(c)	yes	hearth
4	990 N 999 E	I	4	102,108	3 (p) 0 (c)	yes	pit
5	992 N 1006 E	I	1	7,065	0 (p) 0 (c)	yes	shallow pit
Housepit 1: Datum area	995 N 999-1001 E	III-IV	1-3				
Housepit 2: Cut Bank area	1012-1014 N 994 E	III-IV	1-3				

Sampling Strategies for Macrobotanical Remains

A total of 24 sediment samples were collected during excavations at 48PA551 for the purpose of being analyzed for paleoethnobotanical remains. The four archaeological features excavated are all possibly associated with cooking, food processing (Feature 2), storage (Feature 4), and habitation (housepits), which are likely to provide evidence of plant remains in the macrobotanical and microbotanical assemblages. A probabilistic/judgmental sampling strategy was employed in the collection of sediment sample, in which samples were taken intensively from the archaeological features (D’Alpoim Guedes and Spengler 2014:78) as well as contexts where groundstone tools, possibly used in plant processing activities were found. Sediment samples were also taken from contexts not directly associated with features to provide baseline data of botanical material at 48PA551. Following sediment collection and archaeological excavation at site 48PA551 in 2018, Dr. Nicole Herzog conducted a paleoethnobotanical analyses at the Paleodiet Lab at Boise State University. The 24 sediment samples were collected from 10 excavation units (unit 990, 999; unit 992, 996; unit 995, 1000; unit 995, 1001; unit 992, 1006; unit 1010, 993; unit 1012, 994; unit 1013, 994; unit 1014, 994; unit 1057, 1023) from across site 48PA551 and analyzed for macrobotanical remains (Table 3).

Table 3: Sediment samples collected for macrobotanical analysis (highlights indicate dietary significance)

Unit	Level	Bag #	Heavy Fraction Weight	Light Fraction Weight	Charcoal Present	Starch Grain Analysis	Macrobotanical Analysis
990, 999	3	50	809	3	no	-	X
990, 999	4	66	842	4	yes	-	X
990, 999	1	67	761	5	yes	-	X
990, 999	4	71	714	5	yes	-	X
990, 999	4	83	857	2	yes	-	X
990, 999	4	91	903	1	yes	-	X
990, 999	3	119	n/a	n/a	n/a	X	-
990, 999	4	133	n/a	n/a	n/a	X	-
992, 996	4	26	818	3	yes	X	X
992, 996	4	29	704	3	yes	-	X

992, 996	4	31	731	4	yes	-	X
992, 996	1	90	n/a	n/a	n/a	X	-
992,996	1	91	n/a	n/a	n/a	X	-
992, 1006	1	74	867	3	yes	-	X
992, 1006	1	88	709	3	no	-	X
992, 1006	2	95	666	2	no	-	X
995, 1000	1	62	683	3	yes	X	X
995, 1000	1	141	n/a	n/a	n/a	X	-
995, 1001	2	34	871	2	yes	-	X
995, 1001	3	35	707	2	yes	-	X
995, 1001	1	41	777	2	yes	-	X
995, 1001	2	94	n/a	n/a	n/a	X	-
1010, 993	3	108	355	5	no	X	X
1010, 993	3	262	n/a	n/a	n/a	X	-
1012, 994	1	110	769	2	no	-	X
1012, 994	1	111	867	2	yes	-	X
1013, 994	1	56	921	5	no	X	X
1013, 994	1	194	n/a	n/a	n/a	X	-
1014, 994	1	107	1034	3	n/a	X	X
1014, 994	1	229	n/a	n/a	n/a	X	-
1057, 1023	4	18	634	3	yes	X	X
1057, 1023	5	36	702	3	yes	-	X
1057, 1023	4	37	787	3	yes	-	X
1057, 1023	4	63	n/a	n/a	n/a	X	X

Macrobotanical Analysis

Macrobotanical analysis was conducted on one-liter bulk sediment samples collected within and/or adjacent to thermal features identified during excavation. Five bulk sediment samples were collected from non-cultural deposits to be examined as controls. One liter of each sediment sample was weighed and recorded, prior to flotation. The remaining sample being set aside as a voucher for curation and future research. Each sediment sample was assigned laboratory specimen numbers according to excavation unit (e.g. LS# 990, 990.m1), for both samples and voucher fractions. The samples went through the macrobotanical analysis technique of floatation, where the samples are floated in a water bath to separate the light fraction (organic materials) from the heavy fraction (clay, sands, and silts). The technique of manual floatation was used in this analysis.

This process is a simple means to recover carbonized plant remains and charred plant material that are less dense than water and will thus float. Each sample was submerged in water and agitated in a 5-gallon bucket, while another 5-gallon bucket was covered with fine mesh tulle fabric, then the submerged sediment sample was slowly poured and strained through the mesh, a process known as bucket flotation (White and Shelton 2014:101-102). Any floating plant remains are caught by the fine mesh and are known as the light fraction. The light fraction on the mesh was removed from the bucket and allowed to air dry. Once dry the light fraction from each sample was sorted for dietary macrobotanical remains such as seeds, fruits, needles, etc. Light fraction sorting was performed using Leica M60 Stereo and Dino-Lite Digital microscopes. Following sorting and analysis, any macrobotanical remains were removed and bagged, marked sorted, and weighed. The remaining heavy fractions were air dried, re-bagged, labeled, re-weighed and recorded. Identification of macrobotanical remains from the light fraction were made through comparison to macrobotanical reference collections from the Paleodiet Lab at Boise State University and the Natural History Museum of Utah Archaeobotany Lab. Any identified specimens were tallied and placed in small, labeled bags (Herzog et al. 2019: 3).

Table 4: Groundstone collected from site 48PA551 in 2018 (highlights indicate those analyzed for starch grains)

Unit	Quad	Stratum	Level	Bag #	Tool Type	Material	Use Wear
992, 1006	NE	I	1	161	abrader	conglomerate	rounding, grinding
995, 999	NE	I	2	39	abrader	sandstone	rounding, grinding
995, 999	NE	I	3	52	mano	basalt (coarse)	rounding, grinding
995, 999	NE	I	3	56	abrader	sandstone	rounding, grinding
995, 999	NE	I	3	58	abrader	sandstone	rounding, grinding

995, 1000	NE	IV	1	141	metate	sandstone	rounding, grinding
995, 1000	NE	IV	1	164	mano	conglomerate	rounding, grinding
995, 1001	NE	III	1	164	abrader	sandstone	rounding, grinding
995, 1001	NE	IV	1	245	abrader	conglomerate	rounding, oblique striations, grinding
998, 1007	SE	I	1	21	hammer-stone	basalt (coarse)	crushing, battering
998, 1007	SE	I	2	43	mano	basalt (coarse)	rounding, grinding, oblique striations
1010, 993	NE	I	2	93	abrader	sandstone	rounding, oblique striations
1010, 993	SE	I	3	262	abrader	sandstone	rounding, oblique striations, grinding
1012, 994	NW	I	3	236	hammer-stone	sandstone	pecked, battering
1013, 994	NW	I	1	194	anvil	basalt (fine)	crushing, battering
1040, 1002	SW	I	1	70	abrader	sandstone	oblique striations, grinding
1040, 1002	SE	I	1	207	abrader	sandstone	oblique striations, grinding
1057, 1023	SE	I	1	244	abrader	sandstone	rounding, oblique striations, grinding
1057, 1023	NW	I	1	8	abrader	sandstone	rounding oblique, parallel striations, grinding
1057, 1023	NW	I	1	12	abrader	sandstone)	rounding, grinding, pecked
1057, 1023	NW	I	2	14	abrader	sandstone	rounding, grinding, notched
1057, 1023	NW	I	2	16	abrader	basalt (fine)	rounding, grinding

Sampling Methods for Microbotanical Remains: Starch Grains

For microbotanical analysis five groundstone artifacts and five fire cracked rock (FCR) fragments were analyzed for the presence of starch granules and residues (Table 4), along with seven sediment samples as starch granule controls (Herzog et al. 2019: 3). The five groundstone tools and five FCR fragments were associated with excavated features. Upon removal these artifacts were left unwashed and were bagged separately to reduce airborne contamination to starch granules or residues associated with plant processing activities. Starch granules must be

extracted in a laboratory environment. The seven control sediment samples were collected beneath and around where the artifacts were uncovered. These control samples are analyzed under the assumption that starches in sediments surrounding artifacts may have been the cause of the presence of the starches on a tool. The starch present in the controls should result in insignificant levels of starch when compared to starch densities embedded in cracks and crevices of stone surfaces found on groundstone tools used for plant processing (Herzog, et al. 2019:4).

Starch Granule Analysis

The implementation of starch granule analysis influenced the decision to focus on various plants with underground storage organs (USO) that are utilized as carbohydrate rich food sources. Of the seven plants of focus four have USOs in the form of tubers, roots, or corms that are utilized as starch rich food sources (*Claytonia lanceolata*, *Lomatium spp.*, *Perideridia gairdneri*, and *Balsamorhiza sagittata*). Starch granule analysis was conducted on 5 excavated ground stone artifacts and on 5 fire-cracked rock specimens. Starch granules are microscopic plant structures formed by subcellular amyloplast and chloroplasts that function as energy stores. Long-term energy stores are abundant in seeds, fruits, and underground storage organs (USOs) like corms, tubers, etc. During food processing these starch grains are released from cells and can be deposited on archaeological tools utilized in food preparation. Starch grains are relatively resistant to organic decay, unlike macrobotanical remains, and can be well preserved in archaeological contexts ((Herzog et al. 2019: 4). Two small (30 x 30 mm) areas were sampled on each artifact. This process involves limited disruption to the tool surface, leaving remaining residues intact for future research. A heavy liquid separation technique was used to isolate starches from other organic and inorganic material. Analyses were conducted using a compound Nikon microscope with 40x objectives and simple Pol–Analyzer and polarizer. Identified micro-

remains were cataloged and a combination of descriptive and quantitative analyses were used to determine the taxonomic identity of each. These determinations are informed by reference to comparative residue collections held at the Natural History Museum of Utah (Herzog et al. 2019).

Macrobotanical and microbotanical datasets are complementary and provide multiple lines of evidence for a fuller understanding of what plants were being used at site 48PA551 during the Middle Archaic, McKean Complex occupations. The sampling strategies of this project encompasses multiproxy analysis. Pairing these two types of analysis can provide insightful results, “starch provides evidence for plant parts that often do not preserve macroscopically, whereas macrobotanical analyses can provide more detailed taxonomic identification” (D’Alpoim Guedes and Spengler 2014:92). Conducting just one, either macro or micro botanical analysis leaves out important information about archaeological deposits. The information recovered from each type of remains is distinct and sampling for one class of remains is not a substitute for sampling for another.

CHAPTER 7: RESULTS AND DISCUSSION

The ethnographic, botanical survey, and paleoethnobotanical methodologies employed by this study set the groundwork for the contextualization of archaeological remains that can inform hypotheses and expectations, previously discussed in Chapter 5. These methodologies also begin to frame understandings about plant processing and subsistence activities of the Middle Archaic, McKean Complex occupation at archaeological site 48PA551. Intense research into traditional plant use of the Eastern Shoshone from historic ethnographic documents, contemporary interviews, and botanical surveys resulted in a plant catalog, compiled of dietary plants native to the Sunlight Basin of northwest Wyoming and culturally significant to the Eastern Shoshone. Due to the scope of this project, the plant catalog was narrowed down to seven plants of interest. These seven plants provide dietary value through a variety of sources including seeds, USOs, and fruit, providing a higher likelihood that remnants of some of these plants will be observed or recovered from archaeological record through macrobotanical and microbotanical analyses. The resulting plants of focus include 1) *Claytonia lanceolata*, 2) *Lomatium spp.*, 3) *Perideridia gairdneri*, 4) *Balsamorhiza sagittata*, 5) *Ribes americanum/setosum*, 6) *Rosa woodsii*, and 7) *Pinus flexilis* (see Chapter 3 for specific knowledge about plant structure, habitation, and growth patterns). These plants were all discussed in historic ethnographic literature, interviews, and identified during two plant surveys at site 48PA551.

Interviews with Eastern Shoshone elder, Curtis Barney resulted in a wider examination of traditional plant use and proposed project hypotheses. Over the course of these interviews Curtis shared traditional plant knowledge that he fears will be lost to younger generations of the Eastern Shoshone community. Many young tribal members did and still do not grow up learning about traditional plant foods and processing techniques. These discussions ranged from the specifics of

clan migrations, specific plant knowledge, and broader ecosystem knowledge. (Curtis Barney, personal communication, April 26, 2018). The knowledge gained from interviews with Curtis directly aided in the production of the plant catalog for this research. Together, Curtis and I went through historic ethnographic documents of plants, editing uses and spellings. These interviews inform the hypotheses for this project directly related to subsistence patterns and possible winter sedentism. Four clans would migrate together to a winter camp, and then in spring each clan would disperse, to the Platt, Bighorn Flats, Absarokas, and Yellowstone area to gather and collect plants throughout the spring and summer. A seasonal regimen of activities took place prior to the clans rejoining on a winter camp, including picking berries in mid-July to dry and be stored for winter and the collection of plants under the ground surface; potatoes, wild carrots, and other roots and tubers for winter supplies (Curtis Barney, personal communication, April 26, 2018). Through microbotanical starch granule analysis evidence of tuberous plants with USOs have been recovered from groundstone artifacts at 48PA551. Excavations at 48PA551 during the 2018 field season collected sediment samples, ground stone artifacts, and fire cracked rock fragments from contexts associated with archaeological features. The following section examines and reviews the paleoethnobotanical results of macrobotanical and microbotanical analyses of material collected from site 48PA551.

Paleoethnobotanical Results

Sediment samples, groundstone and FCR fragments were examined from across 10 excavation units (990, 999; 992, 996; 995, 1000; 995, 1001; 992, 1006; 1010, 993; 1012, 994; 1013, 994; 1014, 994; 1057, 1023). Of the 10 excavation units, three contained dietary signals of note (units 992, 996; 1010, 993; 1013, 994). Macrobotanical analysis were conducted on 24

sediment samples and microbotanical analyses were performed on 5 groundstone artifacts for starch granules, 5 FCR fragments for starch granules, and 7 sediment samples as starch granule controls. The macrobotanical analysis was conducted by Dr. Nicole Herzog, Liz Dolinar, and undergraduate research assistants at the Paleodiet Lab at Boise State University. Dr. Nicole Herzog conducted the starch grain analysis with assistance from three undergraduate research assistants. What follows is a synopsis of the archaeobotanical report for site 48PA551 (Herzog et al. 2019).

Unit 990, 999 Results

Six sediment samples, one groundstone fragment, and one FCR fragment from this unit were analyzed for archaeobotanical remains. The samples from this unit came from three different levels; LI, LIII, LIV within Stratum I. Most of the samples are associated with Feature 4, a deep pit, possible for storage purposes. The macrobotanical analysis recovered two uncharred needles from an *Abies* sp. (fir) from L1. One unburned leaf-cluster of *Selaginella* sp. (likely densa; spikemoss) was recovered from LIII. Two unburned leaves-clusters of *Selaginella* sp. (likely densa; spikemoss) and one unburned *Picea* sp. (spruce) needle fragment were recovered from LIV. None of the recovered materials appear charred, which suggest that these macrobotanical remains represent food or fuel elements. One groundstone tool and one FCR fragment were analyzed for starch granules. The groundstone tool is from LIII and is not known to be associated with an archaeological feature. The FCR fragment was excavated from LIV, associated with Feature 4. There were no starch granules recovered from either of these artifacts.

Unit 992, 996 Results

Five sediment samples and one FCR fragment from this unit were analyzed for archaeobotanical remains (Table 5). The samples within this unit came from Level IV, Stratum I, associated with Feature 2, a possible hearth (Figure 14). The macrobotanical analysis yielded numerous burned needles from *Picea* sp. (spruce) and *Pinus* sp. (pine), and unburned needles from *Abies* sp. (fir). Unburned immature conifer cones, four unburned leaf-clusters of *Selaginella* sp. (most likely *densa*; spikemoss), and two possible Polygonaceae (knotweed) fruits, one appeared charred (Figure 15). The charred Polygonaceae fruit may represent a dietary item, but it is expected that there would be a larger quantity if it was being prepared at the hearth. Many of the macrobotanical remains appear to be charred, which may suggest they served as fuel (Herzog et al. 2019). One FCR fragment from this unit was analyzed for starch granules. Three starch granules were recovered from this artifact, one of the three was identified as a geophyte producing plants within the Liliaceae family (possible parent-species include *Calochortus* spp. (sego or mariposa lily), *Erythronium grandiflorum* (glacier lily), or *Fritillaria* spp. (leopard lily or yellow bells). The other two starch granules are also likely within the Liliaceae family but could not be definitively identified. There is a possibility that these granules reflect dietary items cooked in the vicinity of the FCR artifact.

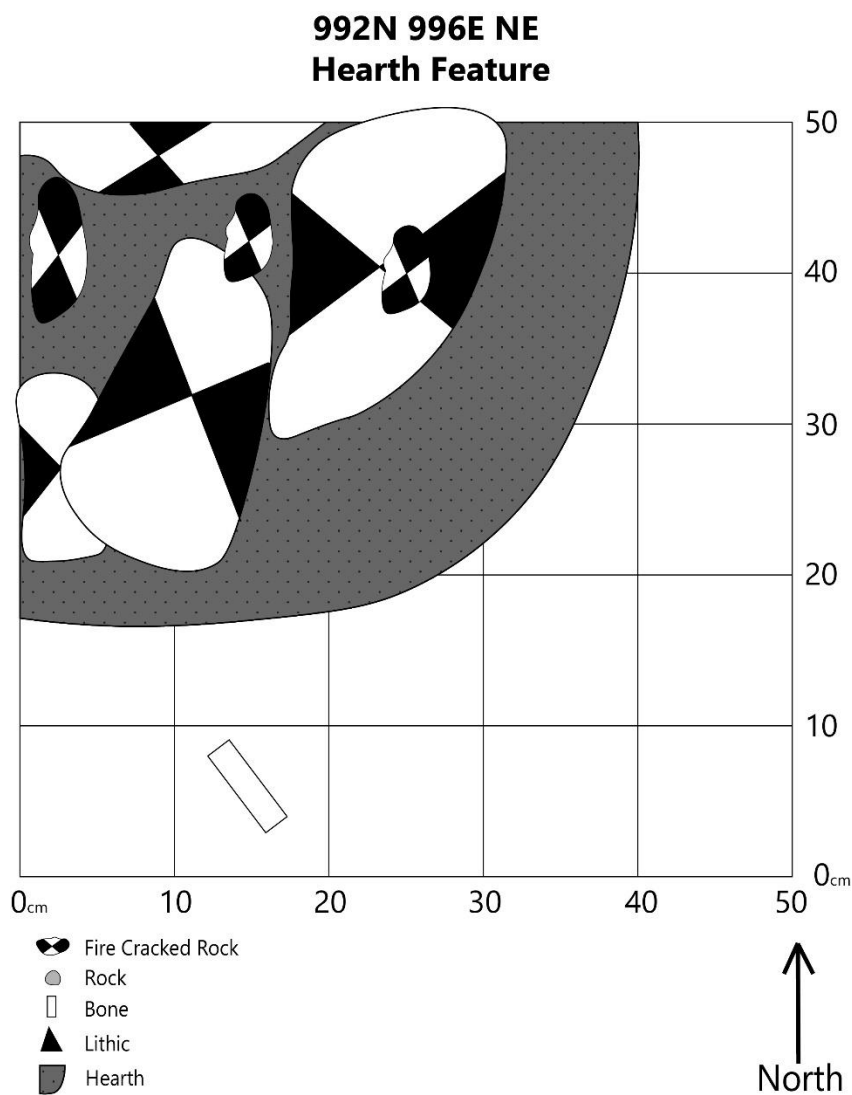


Figure 14: Unit 992N, 996E NE Hearth Feature

Table 5: Recovered archaeobotanical remains from excavation unit 992, 996

Unit 992, 996

Stratum	Level	Associated Feature	Location	Sample Type	Plant Family/Taxon	Description	NISP	Charred
1	4	2	992, 996 (26) NE	SS	<i>Picea</i> sp.	needle	2	yes
					<i>Abies</i> sp.	needle	1	no
					unknown	immature cone	1	no
					unknown	tissue	1	yes
					<i>Pinus</i> sp.	needle	7	no
1	4	2	992, 996 (29) NE	SS	<i>Pinus (flexilis)</i>	needle	2 bundles (5)	no

					<i>Picea</i> sp.	needle	4	yes
					<i>Pinus</i> sp.	needle	6	yes
					<i>Abies</i> sp.	needle	8	no
					unknown	immature cone	2	no
					pos. Polygonaceae	fruit	1	yes
					<i>Selaginella</i> sp.	spikemoss leaves	4	no
					<i>Pinus</i> sp.	needle	2	no
					pos. Polygonaceae	fruit	2	no
					unknown	floral component	3	no
1	4	2	992, 996 (31) NE	SS	<i>Pinus</i> sp.	needle fragment	9	yes
					<i>Abies</i> sp.	needle fragment	3	yes
					unknown	immature cone	1	no
					<i>Abies</i> sp.	needle fragment	1	no
					<i>Pinus</i> sp.	needle fragment	2	no
					unknown	leaf	1	no
1	4	2	992, 996 (91) NE	SS	none identified	-	-	-
1	4	2	992, 996 (91) NE	SS	none identified	-	-	-
1	4	2	992, 996 (90) NE	FCR	Liliaceae	large, pear shaped with lamellae	1	-
					unknown	horizontal crack at eccentric hilum	1	-
					unknown	large, irregular to reniform with stellate fissure at centric hilum	1	-
					unknown	small, irregular sphere with dimple at centric hilum	1	-
1	4	2	992, 996 (26/90/91)	CSS	none identified	-	-	-



Figure 15: Macrobotanical Remains from Unit 992, 996 (fuel, Polygonaceae)

Unit 992, 1006 Results

Three sediment samples from Levels I and II within Stratum I were analyzed from this unit. All the sediment samples are associated with Feature 5, a possible storage pit. Remains from Level I include one possible *Chenopodium* sp. (goosefoot) fruit, one possible Polygonaceae (knotweed) fruit, and one Poaceae (grass) glume. None of these plant remains were charred, suggesting that they do not represent dietary food items. There were no archaeobotanical remains recovered from Level II.

Unit 995, 1000 Results

One sediment sample, one sandstone metate fragment, and one control sediment sample were analyzed for archaeobotanical remains in this unit. The samples came from Level I, Stratum IV and are not associated with any known feature within the unit. Macrobotanical analysis did not yield in any recovered plant remains. Two starch granules were recovered from the metate fragment and one starch granule was recovered from the control sediment sample. These starch granules could not be identified as a particular genus or family. Due to the low abundance of

granules on metate fragment, and presence of starch in the control sediment sample it cannot be determined if the granules on the artifact are associated with plant processing.

Unit 995, 1001 Results

Three sediment samples, one FCR fragment, and one control sediment sample were analyzed from this unit. Each sample was excavated from Levels I and II, Stratum III and Level III from Stratum IV and are associated with a possible pit house feature. Recovered remains from LI and LII, SIII include one unburned *Abies* sp. Needle and remains from LIII, SIV include one unburned leaf-cluster of *Selaginella* sp. (likely *densa*; spikemoss). These remains do not indicate use for fuel or dietary purposes. One starch granule was recovered from the FCR fragment. Two starch granules were recovered from the control sediment samples. Due to the low abundance of granules on the artifact and the presence of two starch granules within the control sediment sample it is inconclusive and unlikely that the starch granule on the FCR artifact is associated with plant processing activities.

Unit 1010, 993 Results

Archaeobotanical analysis on one sediment sample, one sandstone abrader fragment, and one control sediment from this unit (Table 6). All the samples came from Level III, Stratum I and are not associated with any known archaeological features (Figure 16). Macrobotanical analysis did not yield in the recovery of any plant remains. From the starch grain analysis, five starch granules were recovered from the groundstone fragment and one starch granule was recovered from the control sediment sample (Figure 17). The starch granules recovered from the groundstone fragment (milling tool) could not be identified to a parent-species. Possible origins

include the geophytes from the Apiaceae (edible species of *Perideridia* [yampah] or *Lomatium* [biscuitroot] or Montiaceae (*Claytonia lanceolata* [springbeauty])) families. The starch granule recovered in the control sample is likely from a geophyte-producing species of the Liliaceae family (*Calochortus* spp., *Erythronium grandiflorum*, or *Fritillaria* spp.). It is most likely that the starch granules from the groundstone artifact are not from the same parent-species as the granule in the control sediment sample. It is unlikely that their presence on the stone is the result of transference from nearby sediments. The starch granules present on the groundstone tool are suspected to represent and be related to plant processing activities.

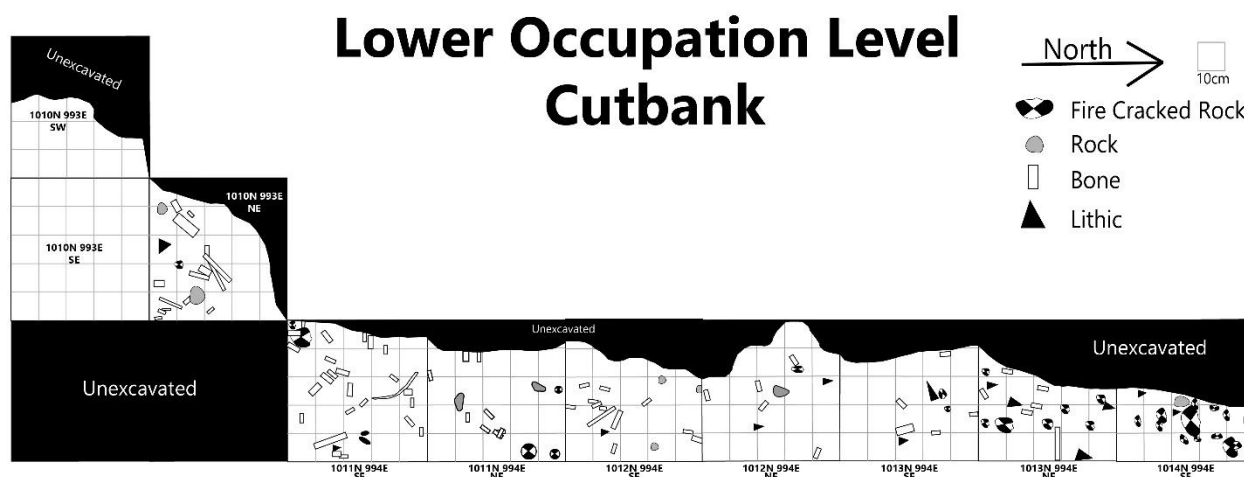


Figure 16: Lower Occupation Level Cutbank, including Unit 1010, 993

Table 6: Recovered archaeobotanical remains from excavation unit 1010, 993

Unit 1010, 993

Stratum	Level	Associated Feature	Location	Sample Type	Plant Family/ Taxon	Description	NISP	Charred
1	3	unknown	1010, 993 (108)	SS	none identified	-	-	-
1	3	unknown	1010, 993 (262) SE	GS (sandstone abrader)	unknown	sm. Spherical with dimple at centric hilum med. spherical with	1	-

					unknown	dimple at centric hilum	2	-
					unknown	lg. bell-shaped with eccentric hilum	1	-
					unknown	lg. spherical with stellate fissure at centric hilum (pos. contaminate)	1	-
1	3	unknown	1010, 993 (108/262) SE	CSS	Liliaceae	lg. ovoid with smooth surface and faint lamellae, eccentric hilum	1	-

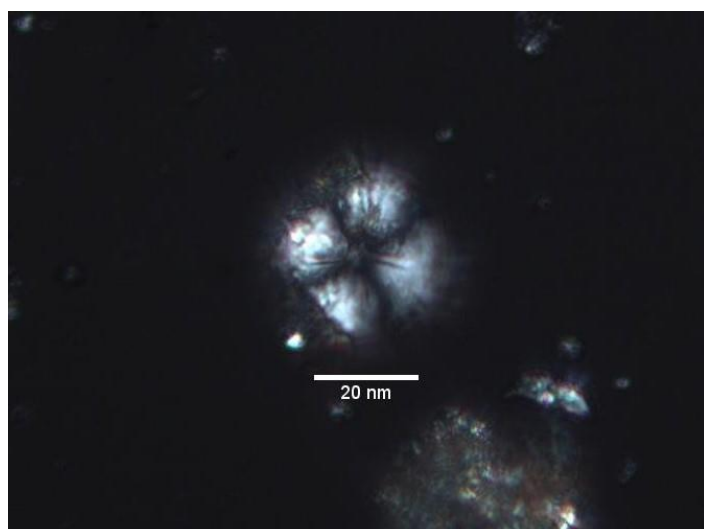


Figure 17: Recovered starch granules from Unit 1010, 993; *Apiaceae* (*Perideridia* spp. & *Lomatium* spp., and/or *Claytonia lanceolata*)

Unit 1012, 994 Results

Macrobotanical analysis on two sediment samples from Level I, Stratum IV of this unit, the samples are associated with a possible pit house. There were not plant remains recovered from either of the samples analyzed.

Unit 1013, 994 Results

One sediment sample, one basalt anvil fragment, and one control sediment sample were analyzed for archaeobotanical remains (Table 7). The samples were both excavated from Level I, Stratum I that is not associated with any known archaeological features (Figure 18). Numerous charred/burned plant parts were recovered during macrobotanical analysis, including one possible *Chenopodium* sp. fruit, one possible Polygonaceae (knotweed) fruit, one possible *Balsamorhiza* sp. (balsamroot) achene, and needles from *Picea* sp. (spruce) (Figure 19). Uncharred remains uncovered include *Pinus* sp. (pine) needles, one Poaceae glume and an unknown seed. The charred remains may represent dietary plant items. The groundstone yielded the recovery of 18 starch granules, twelve of which are identified as originating from underground storage organs (USO) of Apiaceae (edible species of *Perideridia* [yampah] or *Lomatium* [biscuitroot]) or *Claytonia lanceolata* (springbeauty) (Figure 20). Of the 18 starch granules recovered, six of the granules could not be identified to the species, genus, or family-level. It is likely that these unidentified granules came from the same plant species as the other 12 granules. There were no starch granules recovered from the control sediment sample. This suggests that the starch granules on the groundstone tool are likely present due to plant processing activities.

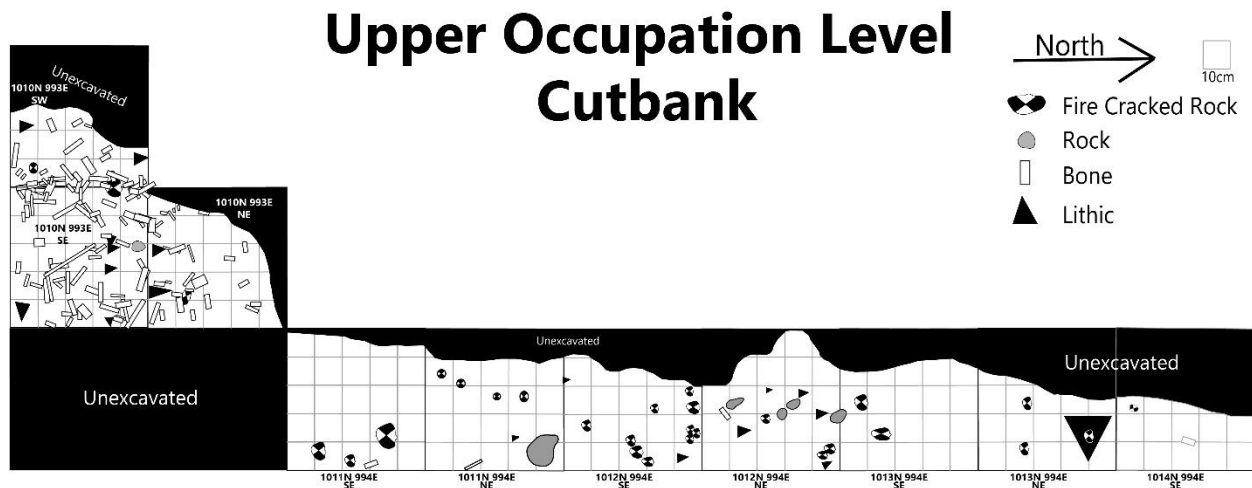


Figure 18: Upper Occupation Level Cutbank, including Unit 1013, 994

Table 7: Recovered archaeobotanical remains from excavation unit 1013, 994

Unit 1013, 994

Stratum	Level	Associated Feature	Location	Sample Type	Plant Family/Taxon	Description	#	Charred
1	1	unknown	1013, 994 (56)	SS	pos. <i>Chenopodium</i> sp.	seed	1	yes
					<i>Picea</i> sp.	needle	1	yes
					pos. <i>Eriogonum</i> or <i>Polygonum</i> sp.	seed	1	yes
					pos. <i>Balsamorhiza</i> sp.	achene	1	yes
					Poaceae	glume	1	no
					<i>Pinus</i> sp.	needle	1	no
					unknown	seed	2	no
1	1	unknown	1013, 994 (194)	GS (basalt anvil)	Apiaceae/ <i>Claytonia</i> l.	Med. irregular-hemispherical with visible lamellae and slightly eccentric hilum	9	-
					Apiaceae/ <i>Claytonia</i> l.	Sm. Part of a triad, pillowing with dimple at centric hilum	1	-
					Apiaceae/ <i>Claytonia</i> l.	Ig. spherical-to-irregular with rough margins,	2	-

					unknown	slightly eccentric hilum lg. spherical pillowing surface with dimple at centric hilum	6	-
1	1	unknown	1013, 994 (56/194) SE	CSS	none identified	-	-	-



Figure 19: Macrobotanical remains from Unit 1013, 994 (pos. *Eriogonum* or *Polygonum*, pos. *Chenopodium*, pos. *Balsamorhiza*)

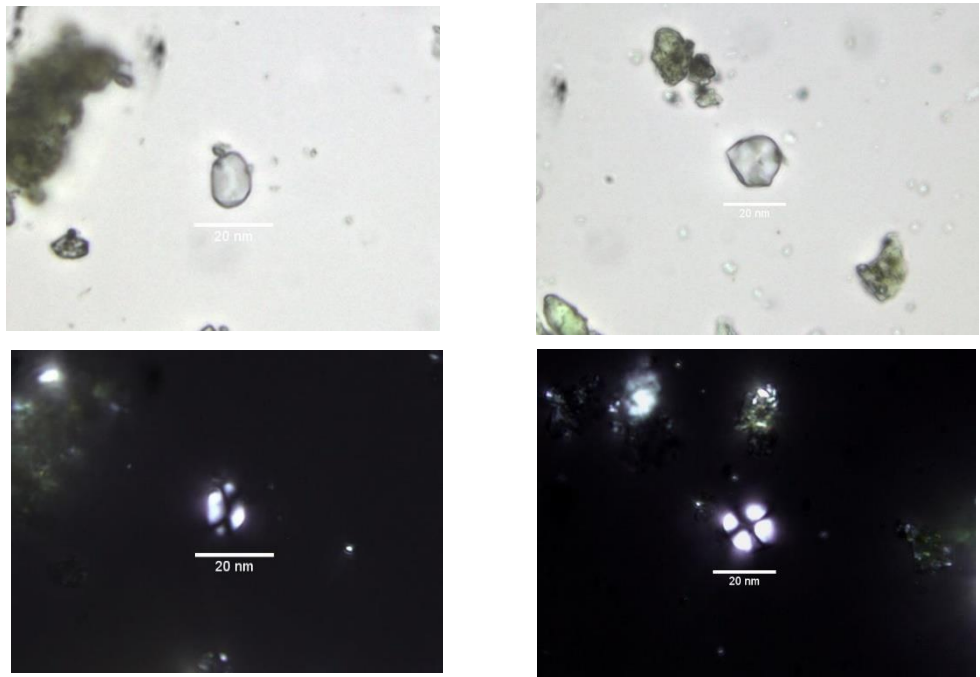


Figure 20: Recovered starch granules from Unit 1013, 994; *Apiaceae* (*Perideridia* spp. & *Lomatium* spp., and/or *Claytonia lanceolata*)

Unit 1014, 994 Results

Archaeobotanical analysis was conducted on one sediment sample, one FCR fragment, and one control sediment sample. The samples are from Level I, Stratum IV and are not associated with any known archaeological features. There were no plant remains recovered from macrobotanical analysis. The starch grain analysis did not recover any starch granules from the FCR fragment, but two starch granules were recovered from the control sediment samples. The absence of granules on the artifact and the presence of starch in the control sediment sample makes it unlikely that this tool was used in plant processing.

Unit 1057, 1023 Results

Three sediment samples, one FCR fragment, and one control sediment sample were analyzed from Levels IV and V, Stratum I of this unit. These samples are associated with Feature 1, a possible hearth. Plant remains recovered from the macrobotanical analysis included one unburned leaf-cluster of *Selaginella* sp. (likely *densa*; spikemoss) from LIV and unknown fruits and seeds, one of which was charred from LV. Based on the lack of macrobotanical remains with only one charred specimen it is not likely that these represent fuel or dietary sources. Three starch granules were recovered from the FCR fragment, but the parent-species could not be identified. The control sediment sample did not yield any starch granules. It is possible that the starch granules on the artifact may relate to plant processing, but the numbers are too low for conformation.

Summary of Paleoethnobotanical Results

The charred local woody species recovered in the macrobotanical analysis were most likely used as fuel, and may indicate that some of the archaeological features were being used as hearths, but the macrobotanical evidence is not robust enough to be considered results consistent with the use of hearths for plant food processing activities. The burned fragments of Polygonaceae, *Balsamorhiza* sp. and *Chenopodium* sp. seeds only appear in a few excavation units, and in very small quantities to be defined as plant foods. The most notable findings of plant food processing at the site are evident in the microbotanical analysis, with the consistent recovery of starch grains from geophytes (plants with underground perennating organs, such as bulbs, rhizomes and tubers) on groundstone tools. The purpose of the starch granule analysis was to recover evidence of what types of plants were being processed with groundstone tools and being incorporated into the diets of inhabitants of 48PA551 during the McKean Complex. The two most notable findings from starch granule analysis include: 1) evidence for the use of geophytes from the Apiaceae family or *Claytonia lanceolata* on a sandstone abrader from unit 1010, 993 and 2) evidence for the use of geophytes from the Apiaceae family or *Claytonia lanceolata* on a basalt anvil from unit 1013, 994 (Herzog et al. 2019). This suggests that the plant foods processed and consumed at the site may have predominately been roots and tuber, and such soft-tissue plant parts that do not appear in the macrobotanical assemblage.

Discussion

Although the findings from the paleoethnobotanical analyses were limited, the results are potentially significant and can inform interpretations of seasonal occupation at site 48PA551. The presence of starch grains associated with geophytes including Apiaceae (*Perideridia* spp. [yampah] and *Lomatium* spp. [biscuitroot]), *Calochortus* spp. (sego or mariposa lily), *Fritillaria*

spp. (leopard lily or yellow bells), *Erythronium grandiflorum* (glacier lily), and *Claytonia lanceolata* (springbeauty). The starch granule remnants found on groundstone tools are most likely indicative of inhabitants processing these starch rich plant foods through harvesting, roasting, and grinding USOs as food during Middle Archaic, McKean Complex occupation at 48PA551. The plant remains that are indicative of dietary significance were discussed both in ethnographic interviews with Eastern Shoshone Elder, Curtis Barney and in historic ethnographic literature. Three of the geophytes identified with starch grain analysis are the focus of this study. *Perideridia* spp. (yamph), *Lomatium* sp. (biscuitroot) and *Claytonia lanceolata* (spring beauty); *Perideridia gairdneri* is named ‘yahmb,’ *Lomatium* sp. is named ‘gu we zap’, and *Claytonia lanceolata* is named ‘soe goe zee nah’ in the Eastern Shoshone language. All the species recovered are typically harvested in early to mid-spring and are processed in much the same way. These tuberous roots were usually roasted, roasted, or dried and processed for storage and future winter use.

These results inform the understanding of the seasonal occupation at 48PA551. The ethnobotanical data in conjunction with preliminary archaeological data seems to suggest that inhabitants of 48PA551 during the McKean may have been a focus on gathering a narrow range of storable plant foods. Small pit houses, external cooking features, refuse pits, and storage facilities may have been used for over wintering purposes, as Prentiss (2019) third hypothesis suggests. One pit (Feature 4) is large and may have been used for food storage purposes. A variety of groundstone tools were also recovered during excavations. Paleoethnobotanical remains recovered from two abraders and one anvil appear to be associated with plant food processing and may be indicative that plant gathering, and processing was focused on

consumption of specific species of highly productive geophytes with relatively high caloric return (Herzog et al. 2019) and with the ability to be stored for future use.

CHAPTER 8: CONCLUSIONS AND FUTURE DIRECTIONS

CONCLUSIONS

Inspired by the growing necessity of collaboration, this thesis demonstrates the importance of incorporating multiple perspectives from distinct disciplines and worldviews into archaeological research. The collaboration with traditional ecological knowledge in this research exemplifies a commitment to both people and place. The inclusion of the traditional plant knowledge of the Eastern Shoshone community can serve to reconnect people to cultural landscapes once inhabited and benefit communities that are alive today through an increased understanding of the past. This research also discusses the biases of past archaeological research, in which ethnobotanical analysis is overlooked in favor of evidence focused on hunting subsistence (Chapter 2). Archaeology's early predilection for hunting as the primary and most important subsistence strategy of hunter-gatherer groups, discounts the roles and agency of those individuals, primarily women, associated with plant gathering and processing activities. This is akin to the dismissal of Indigenous knowledge. The implementation of paleoethnobotanical analysis focuses on the importance of plant gathering and processing activities at site 48PA551 and can begin redress ways gender and gender roles of the past have been presented within anthropology. Collaboration provide a platform in which multiple perspectives and voices can be heard together to better understand our human past.

This research rejects the idea that the distinct knowledge and worldview of traditional ecological knowledge is in opposition to scientific research, rather the inclusion of multiple perspectives can work in unison toward stronger scientific research. This thesis has developed a synthesized body of knowledge that includes the TEK of the Eastern Shoshone, supported by past ethnographic research, plant surveys, and paleoethnobotanical analysis. The collaboration of

all these modes of investigation has revealed that traditional plant knowledge of the Eastern Shoshone can further inform research questions, and in turn further contextualize archaeological material associated with plant gathering, processing, and storage during the Middle Archaic, McKean Complex occupation at 48PA551.

The findings of this research from both ethnographic interviews, paleoethnobotanical analysis, and archaeological evidence appear to indicate that the McKean Complex occupations at 48PA551 may be representative of a winter settlement (Prentiss 2019, hypothesis 3). Eastern Shoshone Elder, Curtis Barney provided descriptions of traditional seasonal migration patterns of Eastern Shoshone clans. The starch grains recovered from excavated groundstone are plant remains of productive geophytes (plants with underground perennating organs, such as bulbs, rhizomes and tubers) with relatively high caloric returns. These findings appear to suggest that there was a heightened focus on the collection and processing of starch rich plants with tuberous roots and corms. Archaeological evidence of small pit houses, external cooking features, refuse pits, and storage facilities may also be indicative of an over winter settlement. The traditional knowledge, paleoethnobotanical analysis, and preliminary archaeological data suggests that inhabitants of 48PA551 during the Middle Archaic, McKean Complex were focused on gathering and processing a narrow range of storable plant foods.

FUTURE DIRECTIONS

This research is still in process and is not a finished product. As research continues it is a goal that collaboration can continue to flourish and intensify over time. Future research would include more interviews with Eastern Shoshone tribal members and elders, along with field visits to areas surrounding 48PA551. Another component of future research would be to facilitate

tribal youth involvement in archaeological research as a way to enhance interest in their cultural heritage. Connecting environmental reconstructions to this region of Wyoming during the Middle Archaic would be useful to future research to provide an understanding of what types of plant were present and prospered during this distinct time period in the Sunlight Basin. This research only considers the traditional ecological knowledge of the Eastern Shoshone Tribe, which limits the understanding of the full range of traditional plant foods of the region. Lastly, future research would include the traditional knowledge of other Indigenous groups, specifically the Crow, Apsáalooke people, to continue work that highlights collaborative frameworks and the importance of more multivocal understandings of the Sunlight Basin.

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APPENDICES

APPENDIX A



Figure A.21: *Claytonia lanceolata* sample, collected near 48PA552, May 24, 2018 (Garrett Herbarium)

Eastern Shoshone: sogo ziina

Scientific Name: *Claytonia lanceolata* **Family:** Montiaceae

Common Name: spring beauty



Figure A.22: *Lomatium cous* sample collected near 48PA551, May 24, 2018 (Garrett Herbarium)

Eastern Shoshone: gu we zap

Scientific Name: *Lomatium* spp. **Family:** Apiaceae

Common Name: biscuitroot



Figure A.23: *Perideridia gairdneri*, sample collected in Teton County, Wyoming (Herbarium of Indiana University)

Eastern Shoshone: yamba

Scientific Name: *Perideridia gairdneri*

Family: Apiaceae

Common Name: yampah



Figure A.24: *Balsamorhiza sagittata* sample collected near 48PA551, May 24, 2018 (Garrett Herbarium)

Eastern Shoshone: do ya o xaya haun

Scientific Name: *Balsamorhiza sagittata* **Family:** Asteraceae

Common Name: arrowleaf balsamroot



Figure A.25: *Ribes oxyacanthoides* var. *setosum* sample collected near 48PA551, May 24, 18 (Garrett Herbarium)

Eastern Shoshone: gweh she bo gum (bo gamp)

Scientific Name: *Ribes setosum americanum*)

Family: Grossulariaceae

Common Name: gooseberry (black currant)



Figure A.26: *Rosa woodsii* sample collected 25 miles west of Cody, Wyoming (Deaver Herbarium)

Eastern Shoshone: zo nape

Scientific Name: *Rosa woodsii* **Family:** Rosaceae

Common Name: wild rose

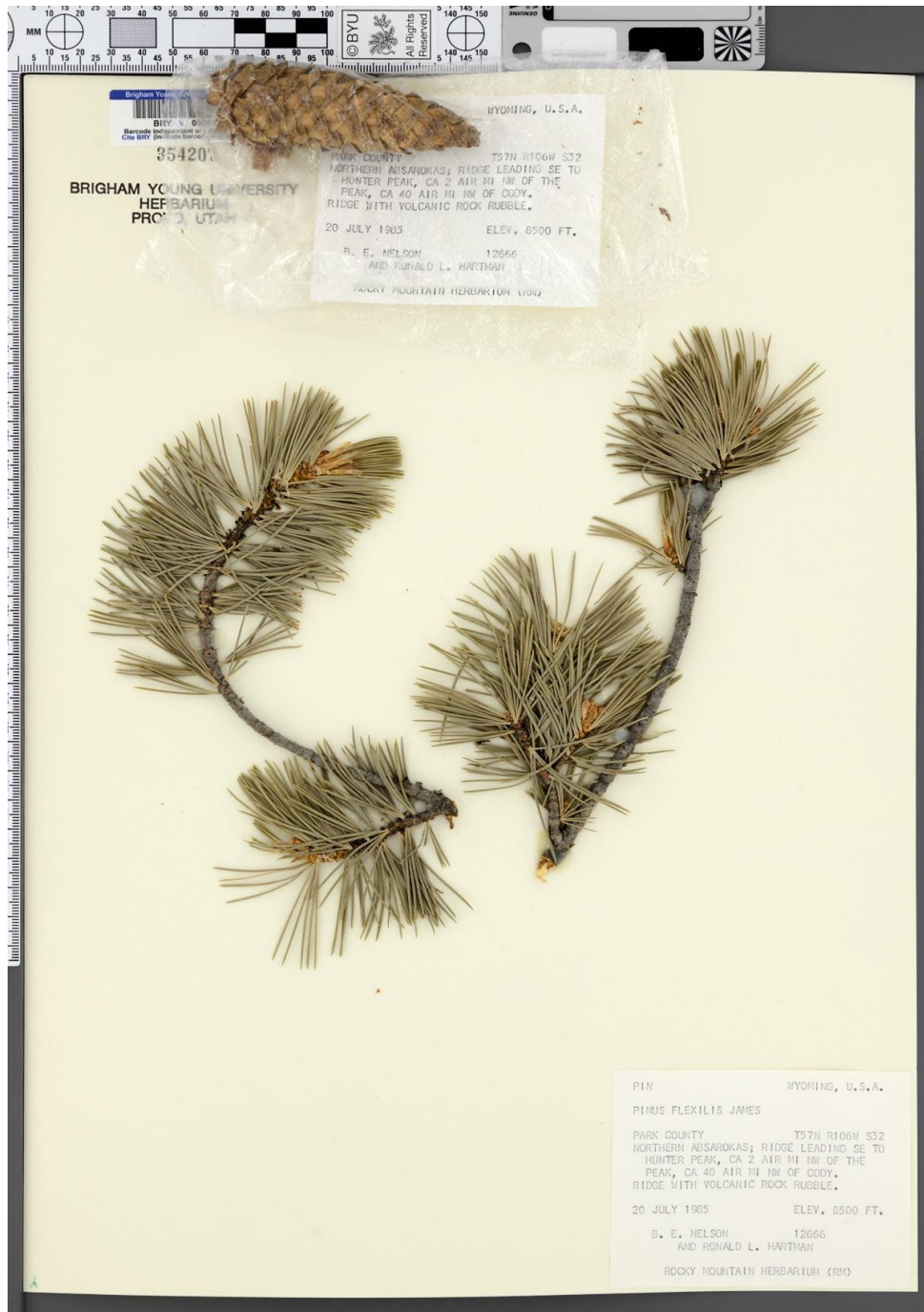


Figure A.27: *Pinus flexilis* sample collected in Park County, Wyoming (BYU Herbarium)

Eastern Shoshone: wongko (generic pine)

Scientific Name: *Pinus flexilis*

Family: Pinaceae

Common Name: Limber Pine